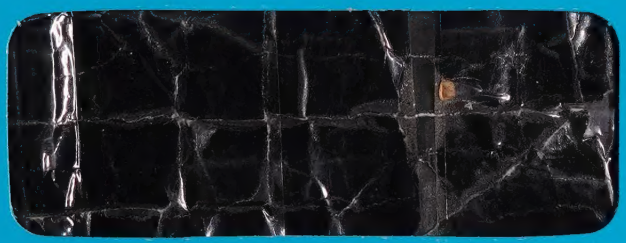
Operating and Service Manual



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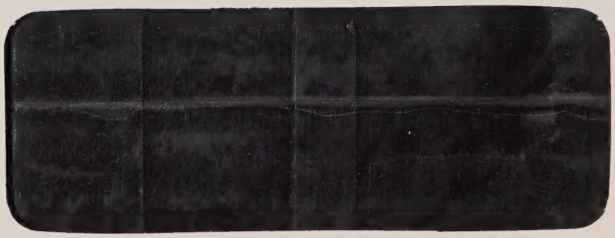

GOULD

MANUAL PART NO.
2007-804200-2X

SURFANALYZER RECORDER

2007-4200-20/26

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SECTION I

GENERAL INFORMATION

1.1 SCOPE

This manual describes the Gould 2 channel Surfanalyzer Recorder (Figure 1-1), and provides instructions for installation, operation, troubleshooting, and maintenance. Theory of operation and calibration procedures are also provided. An illustrated parts breakdown is located in the rear of the manual.

1.2 DESCRIPTION

The Surfanalyzer Recorder is a high performance analog recorder used as periferal equipment for use with the Gould Surfanalyzer precision profile and surfance measuring systems. Each recording channel incorporates frictionless feedback sensors for closed loop control of the pen at high speeds.

Both channels are 100 millimeters wide, providing the greatest full scale display resolution of any direct writing recorder. Rectilinear trace presentation gives a true depiction of surface characteristics and permits accurate two-channel comparison and analysis.

The Recorder uses a pressurized ink writing system to ensure crisp, clean, dry and smudge-free traces of uniform width at all pen velocities. A disposable ink cartridge supplies approximately one year's supply of writing fluid and is easily replaced.

Six chart speeds are pushbutton selected from the front panel and are calibrated in English units (0.1, 0.2, 0.5, 1, 2 and 5 in./sec) and metric units (2.5, 5, 12.5, 25, 50 and 125 mm/sec). Both English and metric chart paper is available in 275 ft (83.8m) rolls. A paper supply indicator helps guard against loss of test data due to paper depletion, and a chart paper interlock stops the recorder when the paper runs out.

Two event markers are standard. One automatically records the direction of traverse, and the other may be manually operated by means of the controller EVENT switch to accent special portions of a chart record.

The new Gould Dual-Channel Recorder is available with two line power options. The Model 2007-4200-20 operates on 115V, 60Hz and the Model 2007-4200-26 operates on 230V, 50Hz.

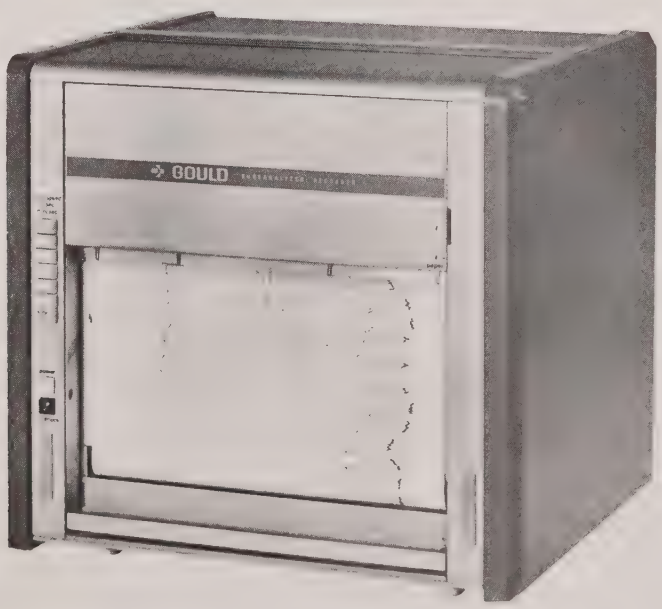


FIGURE 1-1 GOULD 2 CHANNEL SURFANALYZER RECORDER

1.3 SPECIFICATIONS

a. General

Number of Analog Channels	Two
Number of Event Marker Channels	(Two) Left & Right Margin.
Channel Span	100mm.
Trace Presentation	Rectilinear
Trace Width	0.01 inch nominal at 5mm/sec chart speed.
Marking Method	Pressured ink.
Marking Fluid Capacity	One or two one-ounce replaceable throw away cartridges (sufficient for one year under normal operation).
Chart Speeds	.1, .2, .5, 1, 2 and 5 in/sec.
Chart Speed Accuracy	±0.5% synchronous with line frequency.
Chart Length	275 feet (83 meters)
Chart Width	250mm
Divisions per Channel	.1 in/div on 4 inch channel
Time Lines	Every mm, accentuated at 5 and 100mm.
Chart Travel Direction	Top to Bottom.
Paper Discharge	Front
Chart Wander	0.25 mm maximum.
Operating Temperature Range	0° to +50° C (+32° to +122° F)
Storage Temperature Range	-40° to +70° C (-40° to +158° F)
Humidity	95% at 32° C (+90° F) Non-Condensing.
Vibration and Shock	Standard Commerical Practice.
Principle Dimensions (Approx)	14¼" wide x 13¼" high x 13 3/8" deep.

b. Electrical

Input Circuit	Single ended, floating (Phone jack connector)
Imput Impedance	100K ohms ±1%.
Input Signal	±2.5V for full scale deflection of 50, or 100 mm channels.

Frequency Response	At 3.8 inches amplitude: d-c to 30Hz ±1mm. At 1.8 inches amplitude: d-c to 50Hz ±1mm. At 1.6 inches amplitude: d-c to 55Hz ±1mm. At .4 inches amplitude: d-c to 100Hz ±1mm, 3 dB down at 125Hz.
Rise Time (10% to 90% full scale with less than 1% overshoot)	At 3.8 amplitude: less than 8 milliseconds. At 1.8 amplitude: less than 5 milliseconds. At 1.6 amplitude: less than 4 milliseconds.
Non-Linearity	±0.35% of full scale.
Maximum Allowable Signal Input Voltage to Avoid Damage	±50 volts dc or peak ac.
Maximum Safe Common Mode Voltage	500 volts dc or peak ac.
Common Mode Rejection Ratio	60dB at 60Hz (R_s=1 kilohm). 80 dB at dc (R_s=1 kilohm).
Signal Limiters	Built-in adjustable electrnoic and mechanical.
Zero-Line Instability (Drift) After	±0.1% of full scale for 24 hours.
15Minute Warm-Up	±0.025% of full scale per °C ±0.10% of full scale for ±10% line voltage change.
Gain Instability	±0.1% of reading for 24 hours ±0.05% of reading per °C ±0.05% of reading for ±10% line voltage change.
Power Consumption	50 to 60Hz: 160VA +50VA per channel (100W+41W per channel).

1.4 SUPPLIES AND ACCESSORIES

a. Supplies

Chart Paper	
High Contrast, Kromekote (275 feet) 1 mm time line, 250 mm wide	
in mm	11-2913-31
in inches	11-2913-32
Analog Pen	885090
Event Pen	11-2873-20
Ink Cartridge (1 oz)	11-2730-01
Pen Pressure Adjustment - Wrench	1-120922-18
Band, Penmotor	684999
Gram Gage	240610-910
Tube Replacement Tool	267528
Ink Remover	282920

b. Accessories

Starter Kits

All starter kits include 12 rolls of high contrast chart paper, gram gage, one analog pen, lapping paper and pen pressure adjustment wrench. Below are starter kit model numbers.

2-100 mm channels (English) 11-6250-24

Chart Takeup 11-6402-14

Left Event Marker 888775

Right Event Marker 887715

Drive Amp Extender Board 887526

SECTION II

INSTALLATION

2.1 GENERAL

This section contains information necessary to put the recorder into service, including installation of optional equipment.

2.2 SERVICE UPON RECEIPT

Before making signal connections and applying power to the recorder, the following service must be performed:

1. Remove sheet of chart paper from under pens and load roll of chart paper as described in Section VI.

2. Turn ON all ink solenoid valves. These are located behind the pen access cover. Raise cover by pulling out on bottom and sliding back into recorder. Turn on ink cartridges.

3. Remove top access cover and check ink supply. Ink cartridge(s) should be near full. Cover is removed pushing back with palm of hand, then lifting up.

4. Make sure POWER pushbutton is released (OFF).

2.3 LINE VOLTAGE REQUIREMENTS

The last digit of the model number designates line voltage and frequency. Listed below are last digit of model number and line voltage and frequency required.

DIGIT	LINE VOLTAGE & FREQUENCY
0	115 vac @ 60 Hz
6	230 vac @ 50 Hz

2.4 ANALOG SIGNAL CONNECTIONS

The signal input connections are made directly to pen drive amplifiers. A phone jack is provided on each drive amplifier. These are located on the rear of the recorder (Figure 2-1). Use shielded cable (Belden 8422 or equal). Tip is high, ring is low, barrel is com.

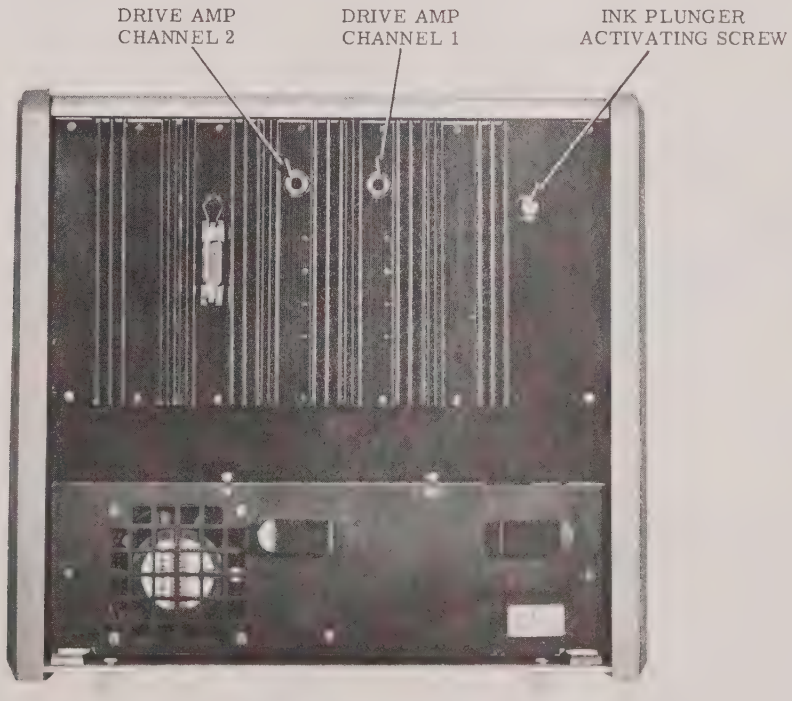


FIGURE 2-1 SIGNAL INPUT CONNECTIONS

2.5 CHART TAKEUP INSTALLATION

Refer to Figure 2-3, and install the optional chart takeup as follows:

1. Disconnect recorder from power source.
2. Remove case from recorder as described in Section VI.
3. Remove plastic caps covering slots in front panel.
4. Position chart takeup on front panel with drive belt on left side. Secure with screws and lock-washers.
5. Slide pulley onto drive roll shaft, and secure with cotter pin.
6. Position drive belt over pulley.
7. Reinstall case.

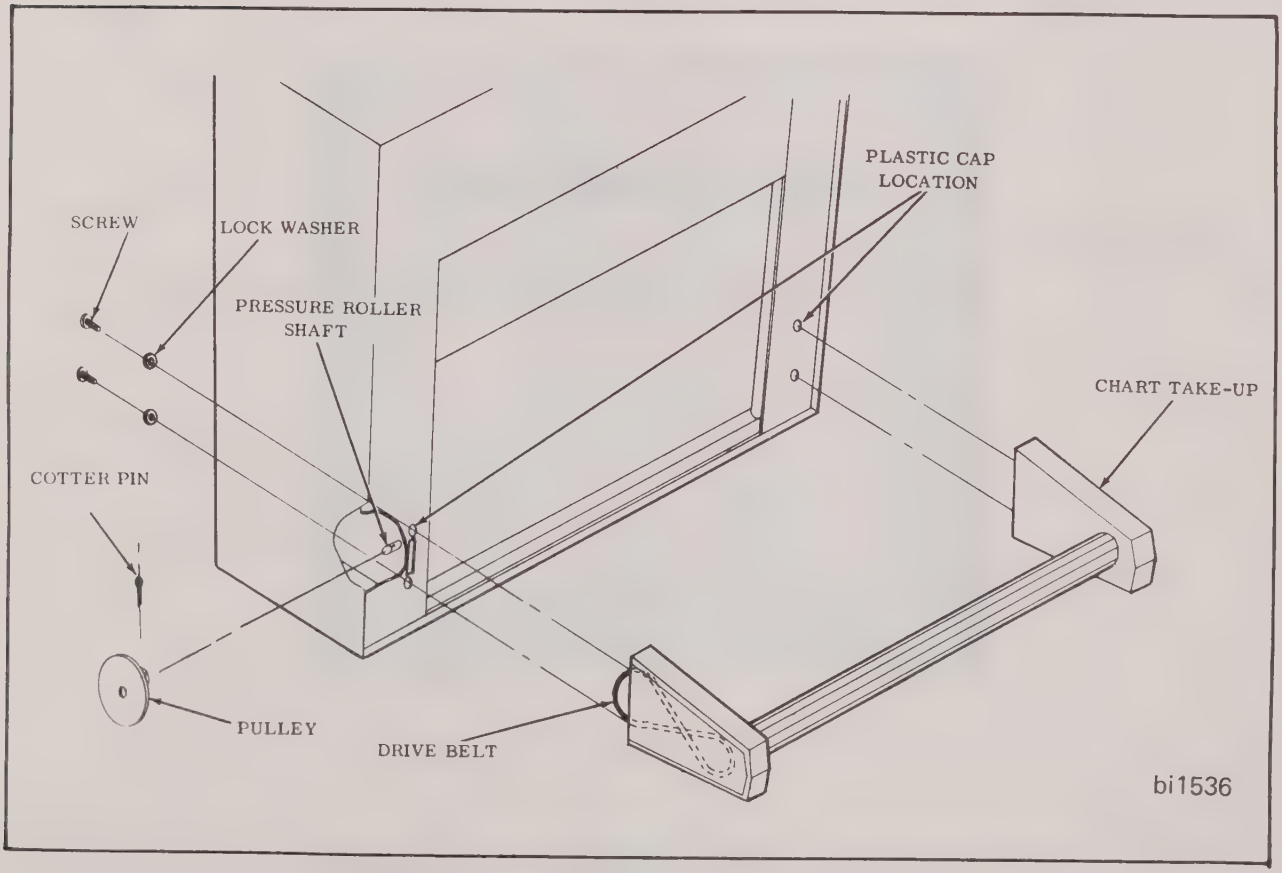


FIGURE 2.2 CHART TAKEUP INSTALLATION

SECTION III

OPERATION

3.1 GENERAL

This section provides complete instructions for operation of the recorder. Functional descriptions of the controls and indicators are provided.

3.2 FRONT PANEL CONTROLS & INDICATORS

Figure 3-1 illustrates the front panel controls and indicators. The following list corresponds to the items called out on Figure 3-1.

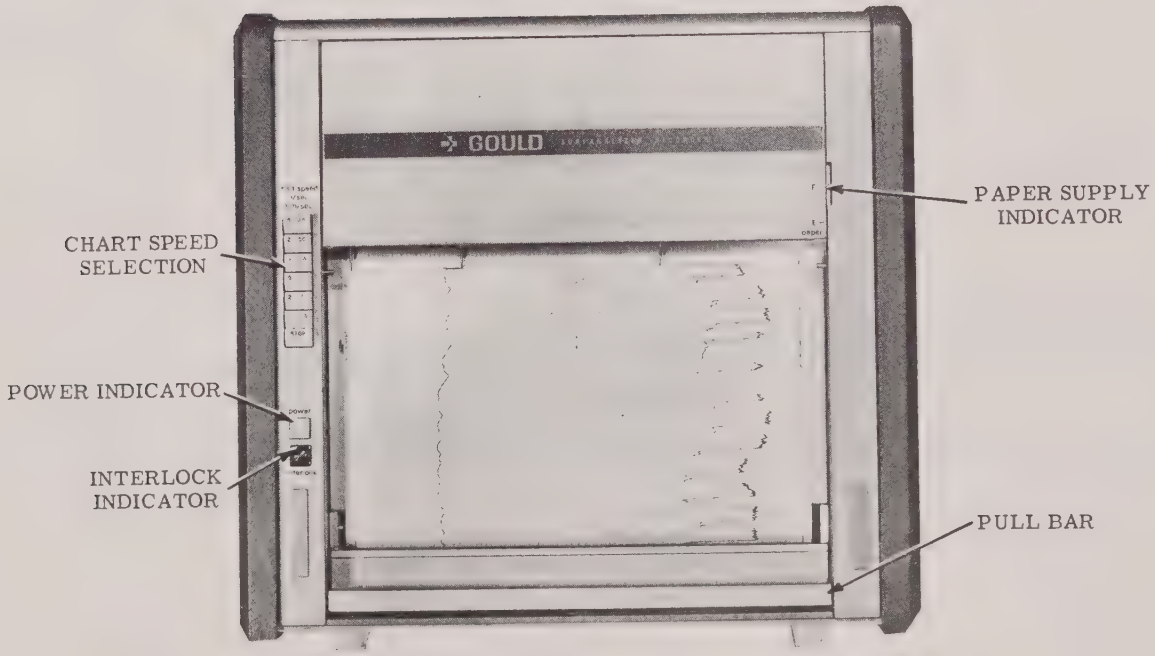


FIGURE 3-1 FRONT PANEL CONTROLS & INDICATORS

CONTROLS	DESCRIPTION
CHART SPEED	Permits selection of six chart speeds and STOP. When in STOP position chart drive is off, and pens will not respond to input signals. Depressing any chart speed button will activate the chart drive at the selected speed. Chart speeds may be changed while chart drive is running. This condition exists only when the controller recorder switch is in the "OFF" position.
PULL BAR	Pull to gain access to chart paper supply roll.
INTERLOCK INDICATOR	Lamp illuminates when writing table is not completely closed or paper supply is exhausted.
POWER	Lamp illuminates when power is on.
PAPER SUPPLY INDICATOR	Gauge to indicate quantity of chart paper remaining.

3.3 REAR PANEL

CONTROLS	DESCRIPTION
SIGNAL INPUT	Jacks for signal input direct to drive amplifiers.
CARTRIDGE ON/OFF	Turns ink supply ON or OFF.

3.4 SETUP AND OPERATION

Prepare recorder for operation as follows:

CAUTION: MAKE SURE ALL PROCEDURES DESCRIBED IN SECTION II, INSTALLATION HAVE BEEN PERFORMED.

1. Check paper supply level. Make sure an adequate supply present for length of time recorder is to be operated and it is properly threaded.
2. Make sure chart STOP pushbutton is depressed.
3. Refer to the Controller manual for proper settings.

SECTION IV

THEORY OF OPERATION

4.1 GENERAL

The 2 Channel Surfanalyzer Recorder is a modular-constructed unit consisting of a mainframe and analog recording channels. Figure 4-1 illustrates a block diagram of the basic recorder.

4.2 MAINFRAME

The mainframe contains a switchboard, control board, control transformer, chart drive motor and transmission and event markers.

a. Switchboard

The switchboard is mounted on the left side of the front panel. It contains the operator control switches CHART SPEED selection and indicators for POWER ON and INTERLOCK.

Chart speed selection is made by depressing one of six SPEED, or STOP pushbutton. The SPEED and STOP pushbuttons are mechanically interlocked to reset a previously selected pushbutton. A combination of three transmission solenoids are activated by the SPEED pushbuttons to obtain the desired chart speed. Table 4-1 defines chart speed versus solenoid activation. The STOP pushbutton interrupts power to the motor/transmission via relay K-101 and resets the SPEED pushbuttons.

TABLE 4-1
CHART SPEEDS VS SOLENOID ACTIVATION

CHART SPEED IN/SEC	SOLENOID ACTIVATED L-102	L-103	L-104
.1	X	X	
.2	X		X
.5	X		
1		X	
2			X
5			

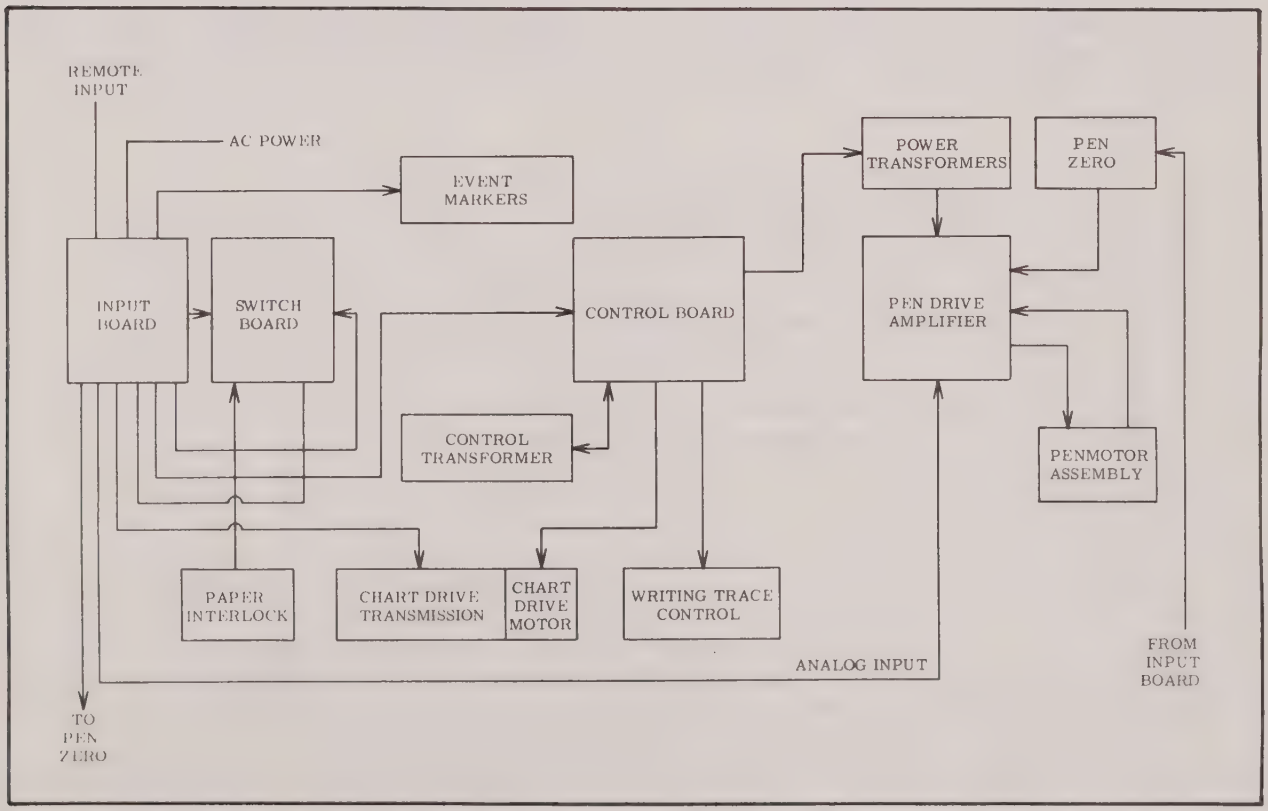


FIGURE 4-1 BASIC RECORDER BLOCK DIAGRAM

b. Control Board

The control board is mounted in the card cage in the rear of the recorder. Contained in the control board are the branch fuses, start/stop relay K-101, the +5Vdc and +28Vdc power supplies.

Fuses are provided to protect each power branch. Table 4-2 shows fuse and circuit protected.

DPDT relay K101 controls power to the chart drive motor, ink solenoids, standard event markers, and optical couplers located in the pen drive amplifiers. It is energized when the chart STOP pushbutton is released. When energized, one set of contacts supplies power to the chart drive motor thru fuse F112 and activates the ink manifold solenoids. When de-energized, the other set of contacts inhibit the event markers and optical couplers in the pen drive amplifiers.

The control board contains two dc power supplies: +28V and +5V. The +28Vdc power source is obtained from bridge rectifier CR102 and control transformer T109. The unfiltered section of this section of the supply provides power to relay K101, and the indicator lamps. The filtered section of this supply provides power to the standard event markers to insure accuracy when precise time events are required. The +5Vdc power source is obtained thru CR102 from a second winding on control transformer T109. This supply is filtered and regulated to provide power for the pen drive amplifier and optical couplers.

Pulsating dc voltage is provided from bridge rectifier CR101 to operate the ink supply solenoids.

4.3 ANALOG RECORDING CHANNELS

a. General

Each analog recording channel consists of a power transformer, pen drive amplifier, and penmotor. The channels are isolated from one another by using separate transformer power supplies and optical couplers. The optical coupler disables the pen drive amplifier whenever relay K101 on the control board is de-energized from depressing chart STOP pushbutton or upon loss of ac power.

Each power transformer has two primary and three secondary windings. The primary windings can be wired in parallel for 115vac operation or in series for 230 vac operation. Two of the secondary windings (±35 and ±15 volts)provide power for the pen drive amplifier. The third (13Vac) is not used.

TABLE 4-2. FUSE VS CIRCUIT PROTECTED

FUSE	CIRCUIT PROTECTED
F101 and F102	Analog channel power transformers T-101 and T-102. Fuses and transformers supplied according to number of channels in recorder.
F109	Control transformer T-109 which supplies power for the +5V and +28V dc power supplies.
F110	Fan motor B-102.
F111	Ink Solenoids.
F112	Chart Drive Motor.

Figure 4-2 shows a block diagram of an analog channel. The penmotor drive amplifier is a complete servo system and uses a linear voltage displacement transformer (Metrisite*) in the penmotor to develop position, and a velocity transducer for velocity. These signals are summed with the input signal in a dc error amplifier which, after amplification, drives the penmotor.

b. Signal Limiter

The input signal enters the signal limiter and is summed with the pen zero signal. The summed signal is fed to a diode bridge circuit. Output from the bridge is limited to ±2.6 volts.

c. Frequency Compensation Network

Output from the signal limiter is fed to a frequency compensation network. Here, the signal's frequency response is adjusted to be flat within 2% from DC to 30Hz for 100 mm pen deflection and from DC to 50Hz for 50 mm pen deflection. The circuit also provides a gain change to allow use with either 50 or 100 mm penmotors. The frequency compensated signal is then fed to summing network where it is combined with error and velocity signals.

d. Oscillator and Demodulator

Position feedback is obtained from the Metrisite. Excitation for the Metrisite is obtained from a 20 KHz Wein Bridge Oscillator. A demodulator attenuates the 20KHz carrier. Output from the demodulator is the position feedback signal.

e. Servo Control Amplifier

The compensated input signal, position feedback, and velocity are summed at the input of the servo amplifier. The output of this stage drives a Class B amplifier, which drives the pen to the proper position on the chart. This occurs when the summed signal is reduced to zero.

*Registered Trademark of Gould Inc.

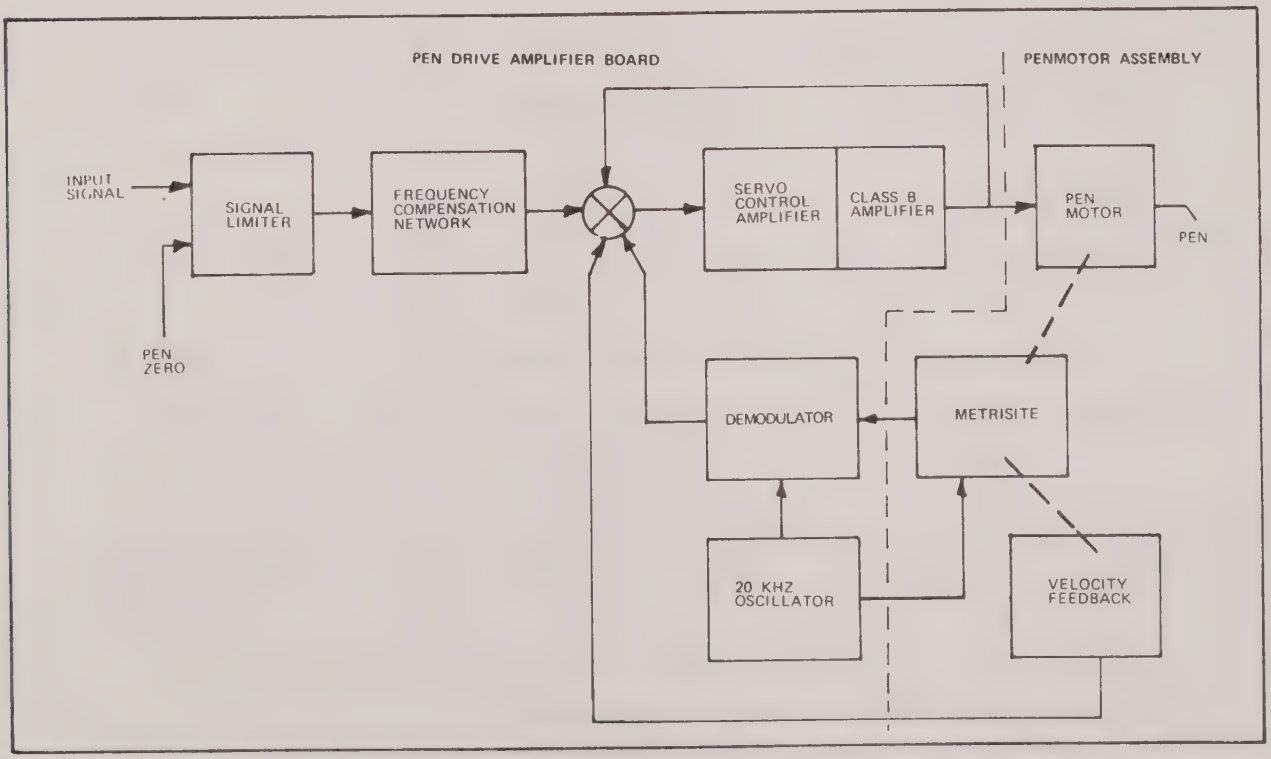


FIGURE 4-2 ANALOG CHANNEL BLOCK DIAGRAM

SECTION V

TROUBLESHOOTING

5.1 GENERAL

This section provides troubleshooting hints to assist the operator and/or serviceman in locating malfunctions that are the possible causes and remedy. If a problem exists which is not identified in this section, contact the factory for assistance.

5.2 ELECTRICAL POWER MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Recorder inoperative (Power ON and INTER-LOCK Lamps are extinguished with power on.	a. Recorder not connected to Controller. b. Fuse F109 blown. c. Connector defective.	a. Connect to Controller. b. Replace fuse. c. Replace connector.
2. Recorder Inoperative (POWER ON and INTER-LOCK Lamps are illuminated.	a. Chart Paper torn or supply is depleted. b. INTERLOCK switch defective.	a. Rethread or replace chart paper. b. Replace switch.

5.3 CHART DRIVE MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Inoperative	a. Desired Chart SPEED button not depressed. b. Drive belt worn or broken. c. Fuses F111 or F112 blown. d. Motor defective. e. Chart speed switch defective. f. Relay K101 defective.	a. Depress desired chart speed button. b. Replace drive belt. c. Replace Fuse. d. Replace motor. e. Replace switch board assy. f. Replace relay.
2. Operative on only some speeds.	a. Chart speed switches defective. b. Transmission defective. c. Broken wire on transmission terminal.	a. Replace switch board assy. b. Replace transmission. c. Repair connection.

5.3 CHART DRIVE MALFUNCTIONS (Continued)

MALFUNCTION	CAUSE	REMEDY
3. Chart speed not accurate or is erratic.	a. Drive roll worn excessively. b. Transmission defective	a. Clean or replace drive roll. b. Replace transmission.

5.4 WRITING SYSTEM MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Trace missing or faint.	a. Ink supply exhausted. b. Screw on ink cartridge not fully counterclockwise. c. Ink manifold valves not in full ON position. d. Pens clogged. e. Ink manifold solenoid defective. f. Ink manifold solenoid de-energized. g. Air in System	a. Replace ink cartridge. b. Turn screw fully counterclockwise. c. Rotate to full ON position. d. Clean or replace pens. e. Replace solenoid. f. Fuse F112 blown: replace fuse. g. Bleed System.
2. Trace heavy or wet; pen gouges paper.	a. Pen excessively worn. b. Pen not properly lapped c. Improper pen pressure.	a. Replace pen. b. Lap pen. c. Adjust pen pressure.
3. Pens not on same time line.	a. Pen (s) out of alignment.	a. Align Pen (s).
4. Pen fails to return to same position each time.	a. Loose pen. b. Loose penmotor linkage.	a. Align and tighten pen. b. Replace penmotor.

5.5 SIGNAL MALFUNCTIONS

MALFUNCTION	CAUSE	REMEDY
1. Trace unusually wide.	a. Noise appearing at the pen tip.	a. Check input signal and connections. Defective drive amplifier board; repair or replace.
2. No signal on any or all channels.	a. Drive amplifier defective b. Drive amp fuse(s) blown. c. Chart speed stop switch defective.	a. Replace drive amplifier. b. Replace fuse(s) after correcting malfunction. c. Replace switch.
3. Pens limp or biased to either side.	a. Drive amplifier defective b. Recorder requires calibration. c. Pen loose. d. Defective pen position pot.	a. Repair or replace drive amplifier. b. Calibrate recorder. c. Align and tighten pen. d. Replace pen position pot.

SECTION VI

MAINTENANCE

6.1 GENERAL

This section contains information for use in preventive and corrective maintenance of the Surfanalyzer Recorder. Refer to Section V, Troubleshooting for guidelines in localizing problem areas.

6.2 CLEANING

a. General Cleaning

CAUTION: AVOID USE OF CHEMICAL CLEANING AGENTS WHICH MIGHT DAMAGE PLASTIC OR PAINTED SURFACES. DO NOT USE CHEMICALS WHICH CONTAIN TOLUENE, ACETONE, OR SIMILAR SOLVENTS.

EXTERIOR: Remove loose dust with a soft cloth or small paint bursh. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

INTERIOR: Dust in recorder interior should be removed occasionally due to its electrical conductivity under high-humidity condtions. Blow off accumulated dust with dry, low-pressure air. Remove any dirt which remains with a soft paint brush or a soft cloth dampened in a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces and/or printed circuit boards.

b. Ink Removal

CAUTION: USE ONLY GOULD INK REMOVER (P/N 282920) TO REMOVE SPILLED INK. THE USE OF OTHER INK REMOVING SOLVENTS IS NOT RECOMMENDED.

1. Blot up any excess ink with a tissue or paper towel.
2. Apply ink remover (P/N 282920) to the inked area ONLY. DO NOT attempt a general cleaning.
3. Gently rub the area with a soft cloth until the ink spot is removed.
4. Wipe the area throughly with a damp cloth.
5. Allow cleaned area to dry at least ten minutes before using recorder.

6.3 CHART PAPER REPLACEMENT

1. Depress chart STOP pushbutton and release power pushbutton.
2. Grasp pull bar (Figure 6-1) and open writing table.

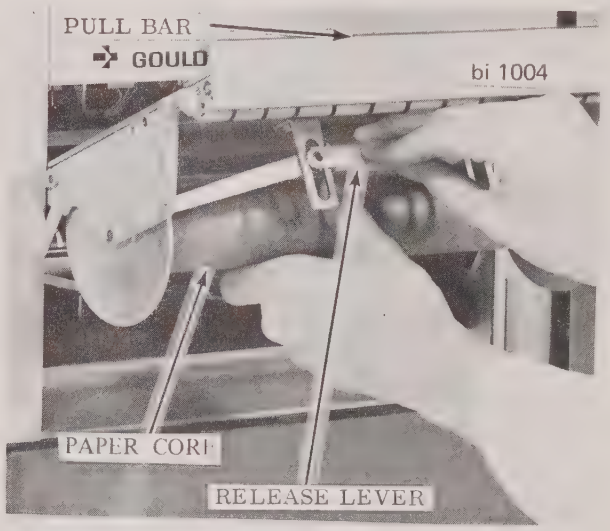


FIGURE 6-3 PAPER ROLL REMOVAL

3. Hold paper supply roll and pull down on paper supply release lever. Remove paper supply roll.
4. Unscrew right flange from paper supply roll. Remove and discard core (Figure 6-2).
5. Slide new paper roll onto supply shaft. Make sure notches in paper core align with guide pins on left flange and paper edge is facing forward and down.
6. Screw right flange onto supply shaft until it is sung against paper edge.
7. Insert paper roll into writing table assembly. Push release lever up to lock into position.

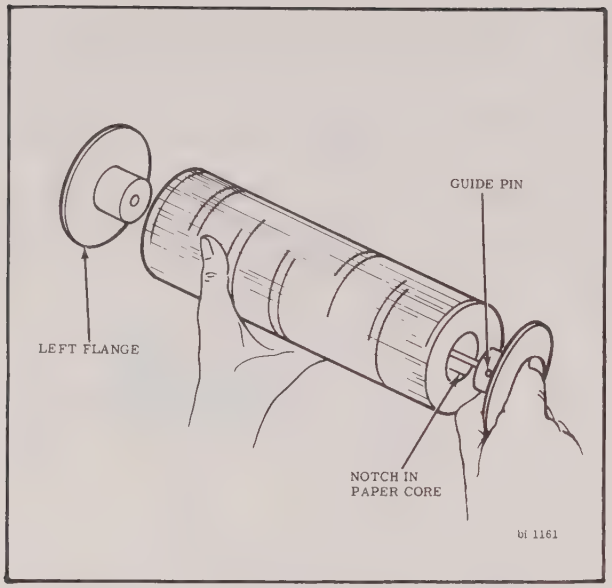


FIGURE 6-2. CHANGING CHART PAPER

CAUTION: MAKE SURE SHAFT IS SEATED PROPERLY AND ROTATES FREELY. USE CARE WHEN THREADING PAPER SO NOT TO DAMAGE PENS.

8. Refer to Figure 6-3. Feed paper over writing bar, down through slot between pull bar and drive roll, around pressure roll, and out to front of writing table assembly.

9. Slowly close writing table while gently pulling on chart paper. When friction resists rotation of paper roll, pull paper taut and center, and close writing table assembly. Make sure table is completely closed.

10. Turn recorder on and run out about two feet of chart paper at 100 mm/sec to align on writing table.

6.4 INK CARTRIDGE REPLACEMENT

Ink supply should be sufficient for one year under normal conditions. Cartridge (s) are located in rear of recorder. Follow procedure below to replace:

WARNING: MAKE SURE POWER IS OFF AND RECORDER IS DISCONNECTED FROM POWER SOURCE.

1. Loosen two screws and pull control board assembly and first drive amplifier board assembly from rear of recorder. Remove top rear cover by sliding it back and lifting out. Refer to Figure 6-4.

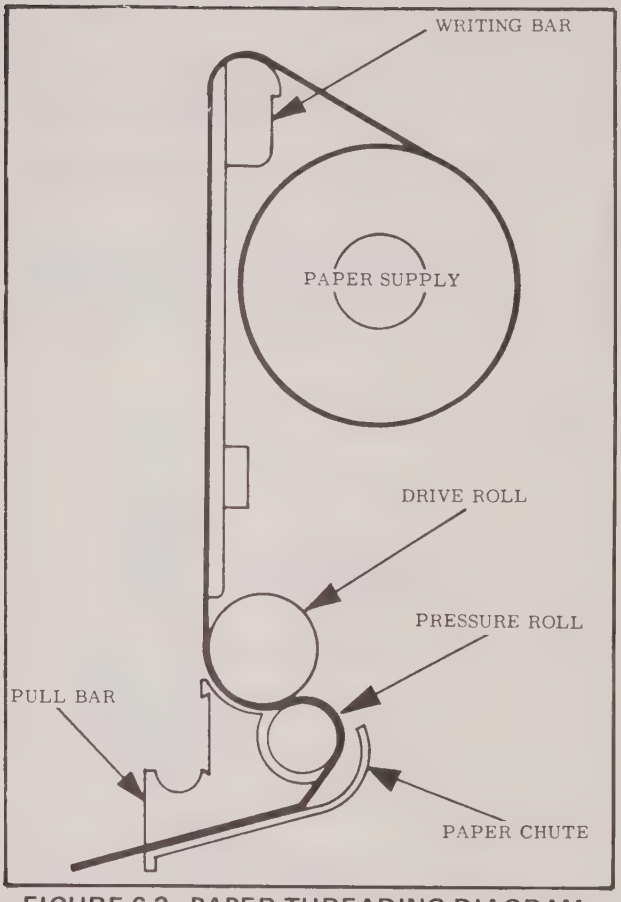


FIGURE 6-3. PAPER THREADING DIAGRAM

2. Turn activating screw clockwise until compression spring in ink plunger assembly is drawn up tight.

CAUTION: DO NOT PERMIT INK TO SPILL ON RECORDER COMPONENTS. PLACE PAPER TOWELS UNDER INK SYSTEM.

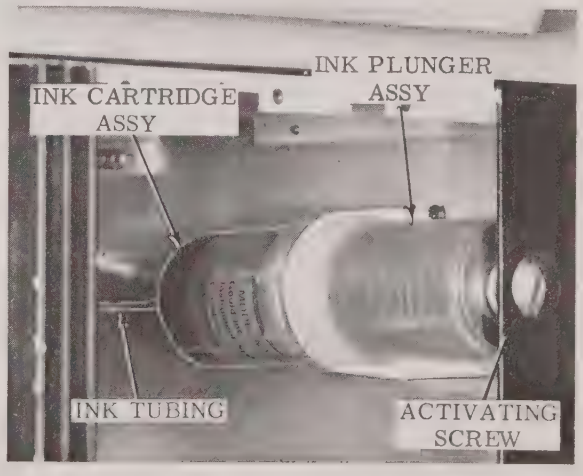


FIGURE 6-4. INK CARTRIDGE REPLACEMENT

3. Carefully pull ink tubing off of ink cartridge.

CAUTION: DO NOT USE TOOLS WHICH MAY GOUGE OR CUT THE INK TUBING.

4. Unscrew ink cartridge from plunger assembly and discard. Refer to Figure 6-5.

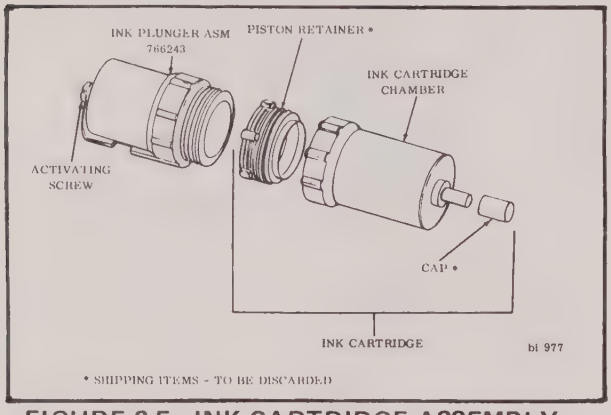


FIGURE 6-5. INK CARTRIDGE ASSEMBLY

5. Remove piston retainer from replacement cartridge and discard.

6. Install cartridge in plunger assembly and tighten firmly.

7. Remove shipping cap from ink cartridge and discard.

8. Install ink tube on ink cartridge.

9. Turn activating screw counterclockwise until snug to pressurize ink system. Check for leaks.

10. Replace control and drive amp boards and top rear cover.

6.5 PEN PRESSURE ADJUSTMENT

Analog or event marker pen pressure should be checked if trace is excessively wide (low pen pressure) or pen gouges chart paper (high pen pressure). A gram gauge (Gould part number 240601-910) is used to measure both analog and event marker pen pressure. Both analog and event marker pens are measured in the same way. Measure pen pressure as follows:

1. Raise pen access cover by pulling out on bottom and sliding back into recorder.

2. Turn ON recorder and set chart SPEED at .1 in/sec.

3. Place gram gage hook under pen as close as possible to top. Form a right angle to pen shaft with hook (Figure 6-6).

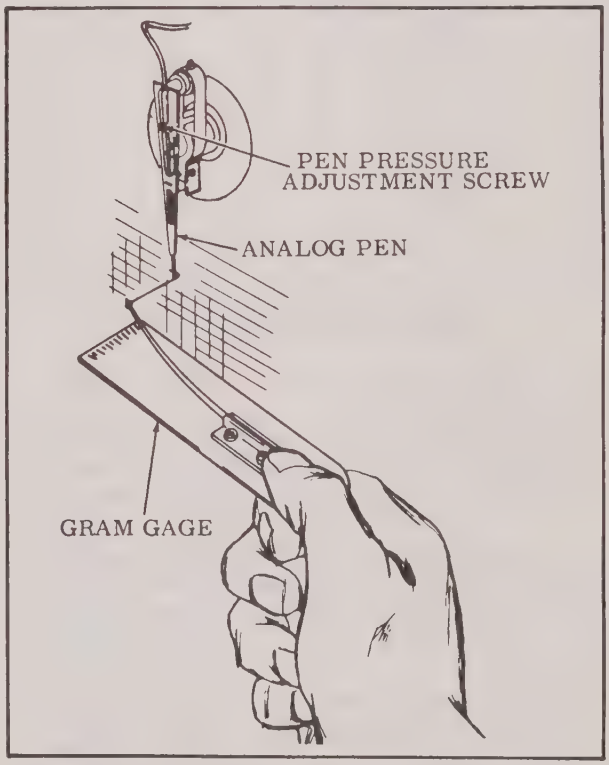


FIGURE 6-6. PEN PRESSURE MEASUREMENT

4. Slowly pull pen from chart paper. Read gage the moment excessive ink starts flowing from pen tip. Proper pressure for analog pen is 30 ±2 grams, for event marker pens 25 ±2 grams.

5. If pen pressure is not within specified limits, adjust pressure using special pen adjustment wrench (Gould part number 1-120922-18). Refer to Figure 6-7. Turn screw clockwise to increase pressure, counterclockwise to decrease pressure.

6. Recheck pen pressure per steps 3 and 4.

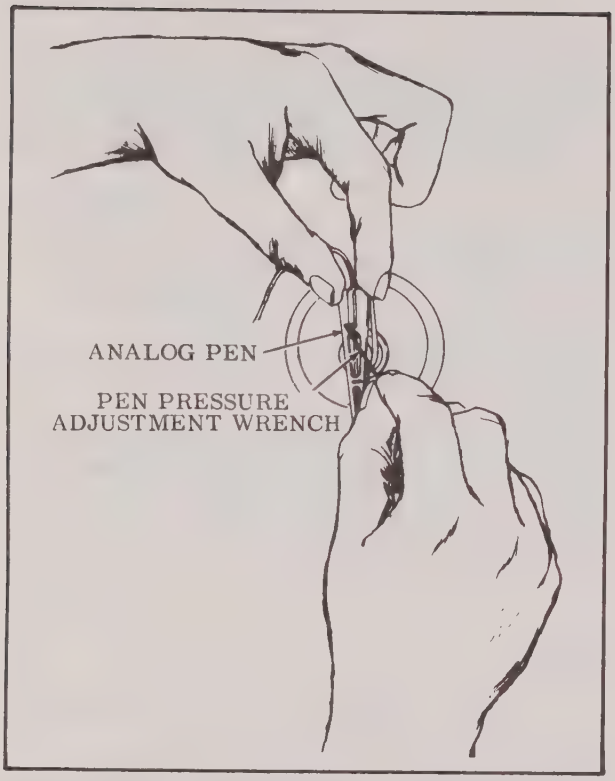


FIGURE 6-7. PEN PRESSURE ADJUSTMENT

6.6 PEN LAPPING

a. General

This paragraph describes and illustrates the proper procedures for lapping the analog and event pens. Intermittent or "wet" ink trace are indications that pen pressure is incorrect or that pen requires lapping. Check for "wet" writing by operating the recorder (no signal applied). Check pen trace by wiping index finger, with moderate pressure, across trace approximately one inch below pen tip. If ink does not smear, pen is properly lapped. If trace smears, check and adjust pen pressure (Para. 6.5). Repeat test, and if trace continues to smear, lapping is required.

b. Lapping Procedures

CAUTION: LAPPING SHOULD ONLY BE DONE WHEN ABSOLUTELY NECESSARY. EXCESSIVE LAPPING WILL SHORTEN PEN LIFE.

1. Turn OFF recorder.

2. Raise pen access cover by pulling out on bottom and sliding it back into recorder.

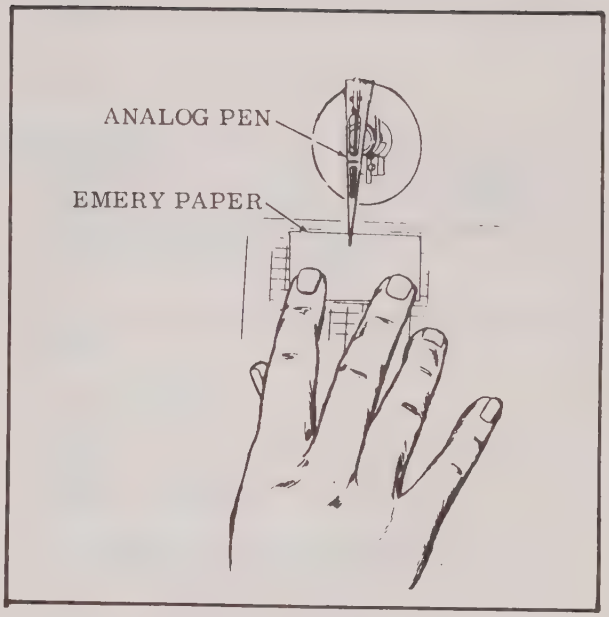


FIGURE 6-8. PEN LAPPING

3. Carefully raise pen tip just enough to slide a small strip of emery paper (600A, Gould part number 669234) under pen tip.

4. Refer to Figure 6-8. Hold emery paper flat against writing table and move it in a circular motion several times while gently pressing pen tip with finger.

5. Remove emery paper and clean debris from pen tip. Operate recorder at .2 in/sec chart SPEED.

6. Check pen trace by wiping index finger, with moderate pressure, across trace about one inch below pen tip. If ink does not smear, pen is properly lapped. If ink smears, check pen pressure per paragraph 6.5.

7. Repeat lapping proceduring if necessary.

8. If pen tip should become blocked during lapping operation, touch pen at top of pen (above tip) with a hot soldering iron for a few seconds with the pen tip raised slightly off the paper. This will usually start ink flowing and flush out abrasive.

9. When dry trace is achieved, turn recorder off.

6.7 PEN REPLACEMENT

Pens should only be replaced when excessively worn or broken. Replacement should be performed only by personnel who are familiar with the recorder. Replace and adjust one pen at a time.

a. Analog Pen

1. Press chart speed STOP button and release POWER button.

2. Raise pen access cover by pulling out on bottom and sliding back into recorder.

3. Turn pen ink valve OFF with a flat-blade screwdriver. Refer to Figure 6-9.

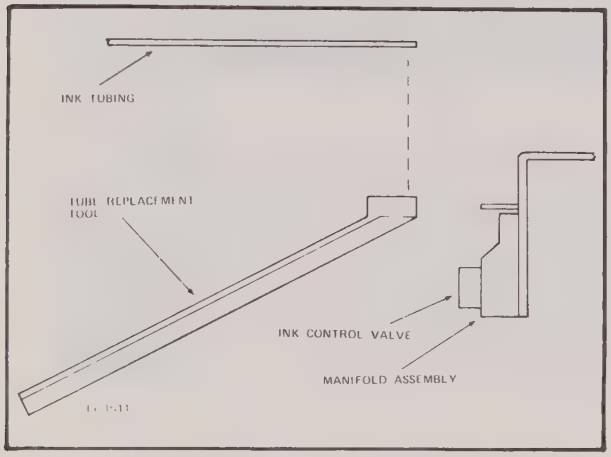


FIGURE 6-9. INK TUBE REMOVAL

4. Carefully remove ink tube from manifold and pen. Wipe off excess ink.

CAUTION: DO NOT PERMIT INK TO SPILL ON RECORDER COMPONENTS. PLACE PAPER TOWELS AROUND AREA.

5. Loosen two screws which secure pen to drive arm and carefully slide pen off (Figure 6-10).

6. Carefully slide new pen onto drive arm. Snug the two screws to secure pen.

7. Install new tubing between manifold and pen.

8. Turn ON ink valve.

9. Turn recorder ON and run at a chart speed of .1 in/sec.

10. Carefully lift pen slightly and allow ink to bleed through pen tip.

11. Shut down recorder.

12. Gently grasp pen near hub and move pen across entire channel. If trace is not parallel to a horizontal line and/or pen is not on same line as other pens, turn pen in screw slots and slide pen vertically. Tighten screws.

13. Lap and set pen pressure per paragraphs 6.5 and 6.6.

b. Event Marker Pen

1. Press chart speed STOP button and release POWER switch on Controller.

2. Raise pen access cover by pulling out on bottom and sliding back into recorder.

3. Turn pen ink valve OFF with a flat blade screwdriver. Refer to Figure 6-9.

4. Carefully remove ink tube from pen and manifold.

5. Loosen adjustment screw and two screws which secure pen to arm, and carefully slide pen off. Refer to Figure 6-10.

6. Carefully slide new pen onto arm. Snug screws to secure pen. (Pen should be perpendicular to writing surface).

7. Install new tubing between manifold and pen.

8. Turn ON ink valve.

9. Turn recorder ON and run at a chart speed of .1 in/sec. Adjust pen ZERO to set pen on event gridline.

10. Carefully lift pen slightly and allow ink to bleed through pen tip.

11. Shut down recorder.

12. If pen tip is not on same line as other pens, loosen screws and slide pen vertically. Tighten screws.

13. Lap and set pen pressure per paragraphs 6.5 and 6.6.

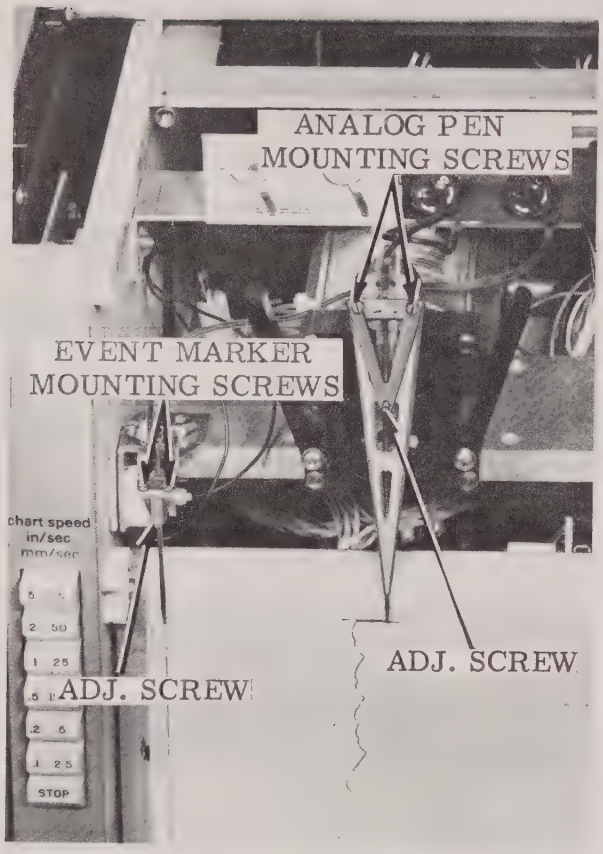


FIGURE 6-10. PEN REPLACEMENT

6.8 PEN CLEANING

Intermittent, missing, or faint traces may be indications of a clogged pen. The following cleaning procedure is intended as a guide, but may not always prove effective.

1. Turn recorder OFF.
2. Close ink valve on affected channel.
3. Remove ink tubing from manifold (Fig. 6-9).
4. Remove pen (Para. 6.7a or 6.7b).

NOTE: Do not remove tubing from pen unless tubing is kinked or suspected of being defective.

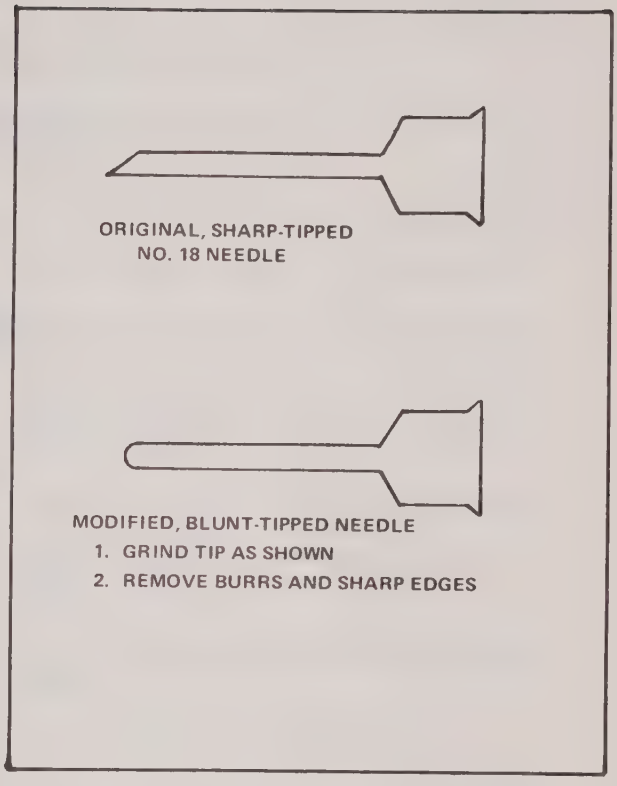


FIGURE 6-11. HYPODERMIC NEEDLE MODIFICATION

5. Modify No. 18 hypodermic needle per Figure 6-11.
6. Attach modified needle onto 2cc hypodermic syringe.
7. With syringe plunger depressed, insert needle in pen tubing.
8. Immerse pen tip in cleaning agent (Isopropyl Alcohol, Cell-O-Solve or equivalent).
9. Back-flush by slowly withdrawing syringe plunger.

NOTE: It may be necessary to allow the pen to remain for a brief period in the cleaning agent to dissolve dried ink at pen tip.

10. Install pen (para. 6.7a or 6.7b).

6.9 CASE REMOVAL

When removing the case, be careful not to damage gears or switchbaord.

1. Remove four large machine screws from bottom of case.

2. Slide recorder out from front of case. Push from rear and/or pull from side plates. Do not pull from top front of recorder.

6.10 DRIVE ASSEMBLY REPLACEMENT

NOTE: Refer to illustrated parts breakdowns of Recorder Assembly, L.H. Plate Assembly, Chassis Assembly, and Drive Assembly in Section VIII.

Remove the drive assembly as follows:

1. Remove case per paragraph 6.9.

2. Remove rear cover assembly (item 43, Figure 8-4) from recorder assembly.

3. Remove blue wire from TB102-2, green/orange wire from TB102-5 and black wire from TB102-6. TB102 is located on L.H. plate assembly.

4. Remove timing belt (item 44) and pulley (item 45) from recorder assembly.

5. Remove 3 machine screws securing transmission to right hand plate assembly and 2 screws securing motor mounting bracket to chassis.

6. Slide drive assembly out of hole in L.H. plate assembly.

7. Slide new or repaired drive assembly into recorder. Watch routing of leads. Be careful not to pinch wires going to TB104 on chassis assembly.

8. Secure transmission to right hand side plate assembly and motor mounting bracket to chassis. Replace timing belt and pulley.

9. Replace wires on TB102; blue, TB102-2; green/orange, TB102-5;black, TB102-6.

10. Replace rear cover.

11. Install recorder in case.

6.11 POWER TRANSFORMER REPLACEMENT

NOTE: Refer to illustrated parts breakdown of chassis assembly in Section VIII.

Replace power transformer(s) item 5, Figure 8-16) as follows:

1. Remove recorder from case per paragraph 6.9.

2. Remove paper supply roll per paragraph 6.3

NOTE: Note and record color codes on transformers to assist in reassembly.

3. Remove two machine screws securing transformer (5) to chassis (4).

4. Slide out defective transformer and replace.

5. Secure transformer with machine screws and reposition leads.

6. Replace paper supply roll and install recorder in case.

6.12 TABLE ASSEMBLY REPLACEMENT

NOTE: Refer to illustrated parts breakdowns of L.H. Plate & Writing Table assemblies in Section VIII.

Replace table assembly as follows:

1. Remove recorder from case per paragraph 6.9.

2. Remove paper supply roll per paragraph 6.3.

3. Remove catch (item 15, Figure 8-6) from L.H. Plate Assembly.

4. Remove two retaining rings from table arms and carefully pry arms out of plate assemblies. Do not bend arms.

5. Tilt table slightly and pull out of recorder removing right and left hand lever assemblies.

6. Mount new or repaired table assembly on lever assemblies. Slide table into recorder and snap arms into side plate holes. Replace retaining rings.

7. Replace catch and washer, Make sure lever is below catch.

8. Replace paper supply roll and install recorder in case.

6.13 MANIFOLD ASSEMBLY REPLACEMENT

NOTE: Refer to illustrated parts breakdown of recorder assembly in Section VIII.

Replace manifold assembly (item 27, Figure 8-4) as follows:

1. Remove recorder from case per paragraph 6.9.

2. Turn OFF cartridge and all ink valves.

3. Place paper towels around area underneath manifold assembly.

4. Pull off ink tubing from manifold to pens and manifold to ink cartridge(s).

5. Remove four machine screws which secure manifold assembly to side plates. Lift out manifold assembly.

6. Install new or repaired manifold assembly insuring that manifold bracket is bottomed.

7. Replace tubing to manifold assembly.

8. Turn ON ink cartridge(s) and ink valves. Check for leaks.

9. Install recorder in case.

6.14 PENMOTOR REPLACEMENT

NOTE: Refer to illustrated parts breakdown of recorder assembly, manifold assembly and penmotor bar assembly.

Replace penmotor as follows:

1. Remove recorder from case per paragraph 6.9.

2. Turn OFF manifold valve to penmotor to be replaced.

3. Place paper towels around area underneath penmotor to be replaced

4. Pull out ink tubing from pen assembly.

5. Loosen the four machine screws which secure the manifold assembly. Raise manifold assembly as far as it will go and snug screws.

6. Remove paper supply roll (see paragraph 6.3).

7. Remove pen assembly by loosening the two screws which secure it to drive arm and carefully slide off. Refer to Figure 6-10.

8. Remove two socket head screws which secure penmotor to penmotor bar. Disconnect plug and pull penmotor out of recorder. The saddle is a loose part.

9. Install new penmotor, securing with the two socket head screws. Connect plug to penmotor.

10. Loosen manifold assembly screws, lower manifold assembly, and tighten screws.

11. Replace paper supply roll and close table.

12. Install pen assembly per paragraph 6.7a, steps 6 through 13.

13. Install recorder in case.

6.15 REPLACING PENMOTOR DRIVE BAND (684999)

NOTE: Prior to replacing drive band, penmotor assembly must be removed from recorder. Refer to Paragraph 6.14 for removal and reinstallation. Frequency Response Spec. should be re-checked after reinstallation. Refer to Section I.

CAUTION: IT IS RECOMMENDED THAT THE DRIVE BAND BE REPLACED AT THE FACTORY SO THAT PROPER BAND TENSION IS MAINTAINED. SHOULD FIELD REPLACEMENT BECOME NECESSARY, PERFORM THE FOLLOWING STEPS.

NOTE: Refer to Figure 6-12 for sequence of replacement.

a. Band Removal

1. Remove Analog Pen Assembly.

2. Loosen (but do NOT remove) screws from either end of assembly.

3. Remove band by sliding free end in counter-clockwise direction thru outer clamp and inner clamp; then thru extrusion and pulley on drive arm assembly.

4. Conclude removal by gently pulling band from inner clamp.

b. Band Replacement

1. Place hooked (or bent) end of band over inner clamp as shown, and restring in clockwise direction thru pulley and extrusion, and inner and outer clamps.

2. Snugly tighten all screws.

3. Apply 5.5 to 6.5 lbs. of tension to free end of band with spring tension scale or other means.

4. Maintaining tension, fully tighten all screws and apply Glyptal cement (Gould P/N 11370) or equal at screwheads and mating surfaces.

5. Remove tension.

6. Replace Analog Pen.

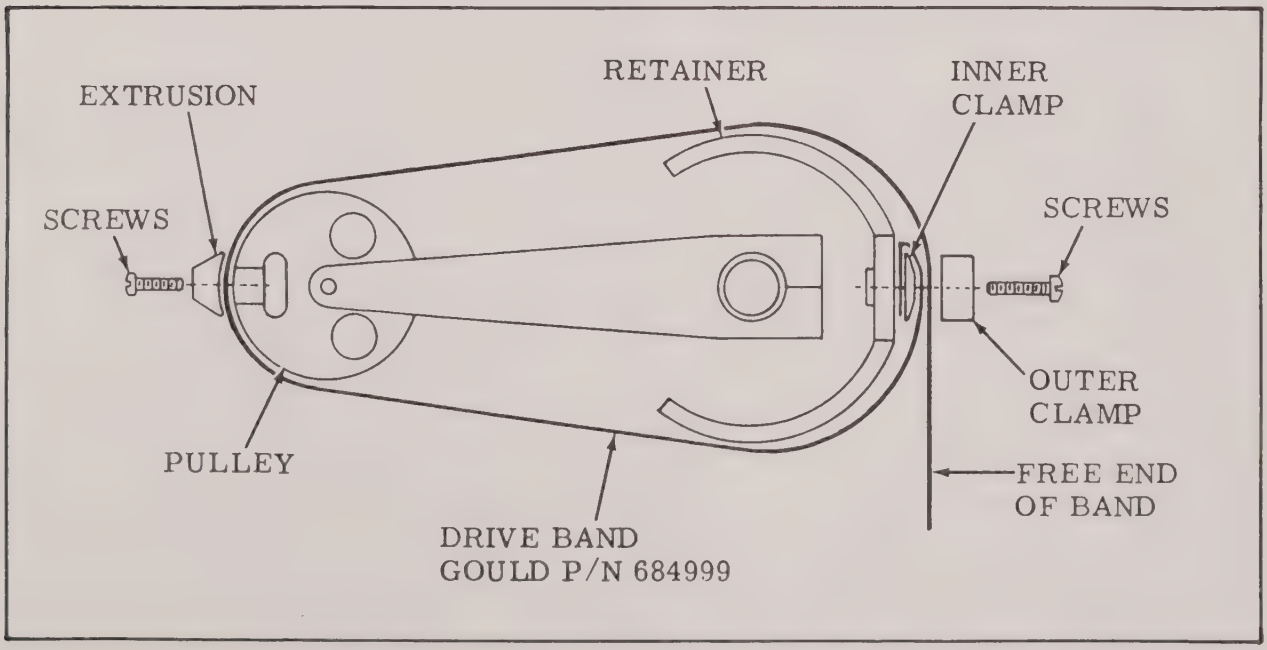


FIGURE 6-12 PENMOTOR DRIVE BAND REPLACEMENT

6.16 MAINTENANCE TIPS ON INK SYSTEM

The following tips are supplementary to the maintenance procedures described in this section and are recommended for maximum performance and trace quality.

1. Never allow water to enter the inking system or pen. It can precipitate the dye out of the ink and cause clogging. For cleaning use ethyl alcohol or an ethylene glycol ether compound.

2. If ink accumulates at the pin tip after chart drive is shut off and pen tip is raised, there is probably air in the lines. Air can enter when a pen is changed or the writing table is left open and will cause skipping of the trace. To eliminate this, run chart at a slow speed and lift the pen tip away from the chart slightly. Allow ink to bleed until air pockets have escaped from the pen tip. Wipe the excess ink with a tissue stroking towards chart center to avoid staining the writing table.

3. When replacing plastic ink tubing after changing a pen or ink cartridge, be sure the tubing fits snugly over the mating parts. Damaged tubing, or tubing with ink on it can cause trouble. Ink acts as a lubricant and may cause a loosely fitted tube to slip off.

4. Never use the shut-off valves in the system to throttle ink flow. They are intended to be either fully open or closed. Also it is best not to shut off ink to unused channels because the ink lubricates and reduces pen tip wear and prevents paper particles from clogging the pen.

5. Always store the recorder with the pen tip against the paper, for exposure to the atmosphere will dry the ink at the tip. Should this occur, simply operate the chart drive and heat the pen tip with a soldering iron or cigarette, and lift the pen slightly to allow the dried ink to flush out.

CAUTION: Do not use an open flame to perform this operation as the ink is flammable.

6. Should the need arise to clean up any ink after changing pens or cartridges use ink remover cream, Gould part number 282920.

SECTION VII

CALIBRATION

7.1 GENERAL

The Gould Surfanalyzer Recorder has been factory calibrated. Under normal conditions, it will not be required, however, calibration may be required when parts are replaced. This section describes the procedures necessary to calibrate the Recorder. Calibration should only be performed by qualified individuals.

7.2 TEST EQUIPMENT REQUIRED

Proper test equipment is essential. Use the equipment specified below or its equal.

a. Function Generator - Wavetek Model 110.

b. DC Calibration Source - Digitec Model 311.

7.3 PRELIMINARY SETUP

a. Depress recorder STOP button.

b. Plug ac line cord into the proper ac voltage source.

c. Turn ON the recorder.

7.4 CALIBRATION PROCEDURE

a. Drive Amplifier Board

Calibration controls and procedures are identical for both channels. Refer to Figure 7-1 and calibrate each pen drive amplifier as follows:

1. Remove the Recorder top rear cover to gain access. Slide cover back and lift out.

2. Connect dc calibration source to phone jack input of drive amplifier. Tip is high, ring is low.

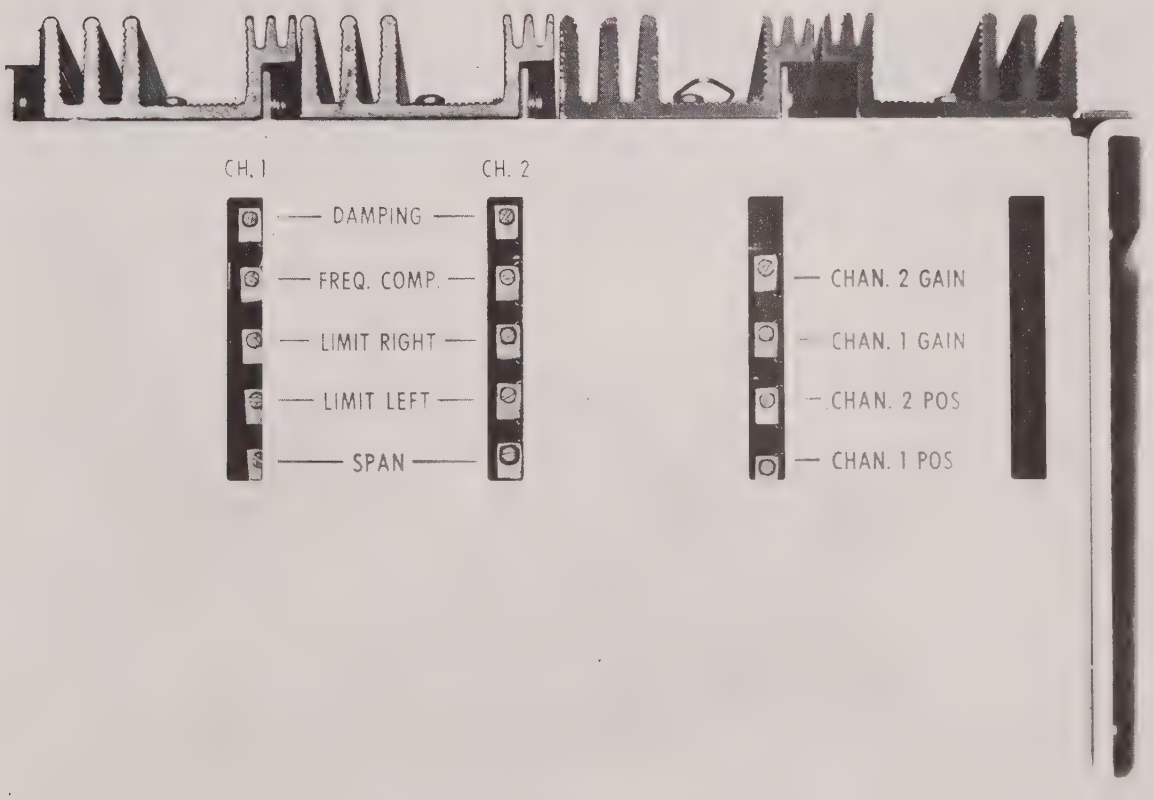


FIGURE 7-1. CALIBRATION CONTROLS

3. Press recorder .1 in/sec CHART SPEED push-button.

4. Set dc calibration source to ZERO.

5. Set pen at channel center with pen position control on input board.

6. Using telephone jack, apply a +2.5 vdc ±0.25 mv signal to drive amplifier and adjust SPAN potentiometer (R-201) for a 50% of full channel width deflection within 0.1%.

7. Return dc calibration source to zero.

8. Turn pen position control full counterclockwise. Pen should deflect left to between 1.0 and 2.0 mm beyond full scale.

9. If deflection is NOT between 1.0 and 2.0 mm beyond full scale, adjust LEFT LIMIT potentiometer (R-202) for a 1.5 ±0.25 mm deflection beyond full scale.

10. Turn pen position control full clockwise. Pen should deflect right to between 1.0 and 2.0 mm beyond full scale.

11. If deflection is NOT between 1.0 and 2.0mm beyond full scale. adjust RIGHT LIMIT potentiometer (R-203) for a 1.5 ±0.25 mm deflection beyond full scale.

12. Connect function generator.

13. Apply a 4V p-p square wave with a 1.0Hz repetition rate.

14. Turn DAMPING potentiometer (R-204) clockwise until an overshoot is obtained. Then, turn slowly counterclockwise until overshoot is reduced to zero.

15. Check overshoot at 20 and 100 percent pen deflection. No overshoot should be present. Repeat Step 24 if necessary.

16. Increase chart speed to .5 in/sec.

17. Apply a 5Hz sine wave, and adjust amplitude to obtain a 16 div pen deflection.

18. Slowly increase frequency to 50Hz. Pen deflection should be within .005 in. of that at 5 Hz.

19. If necessary, adjust FREQUENCY COMP potentiometer (R-205) until 50Hz deflection is within .005 in. of the 5Hz deflection.

b. Input Board

1. Adjust each channel zero to center chart, then apply a ±3.125 vdc to input for each channel (pins 7 and 14). Pins 8 and 15 are common respectively.

2. Adjust the respective gain control for full scale deflection ±.010 inch.

SECTION VIII

PARTS IDENTIFICATION

8.1 GENERAL

The Surfanalyzer Recorder has been accurately calibrated and adjusted before shipment from the factory, and should give long trouble-free service. For servicing beyond the scope of the instructions contained in this manual or the technical equipment available, contact your nearest Gould Service Engineer listed on the warranty card shipped with the recorder.

The following parts lists and schematic diagram are designed to assist in servicing and repairing the recorder.

To assure prompt and satisfactory delivery of replacement parts, include the following information with your purchase order:

1. Name, model number, and serial number of the instrument (e.g., Gould Surfanalyzer Recorder, Model 2007-4200-20/26, Serial Number XXX).

2. Description of part as listed in this manual.

3. Gould part number.

NOTE: Do not use the SYMBOL NUMBER from the parts list for identifying desired parts on the order.

EXPLODED VIEW PARTS LIST
SURFANALYZER RECORDER
FIGURE 8-1

ITEM NO	PART NUMBER	DESCRIPTION
1	2007-4200-20	Recorder Assy, 115V, 60Hz (See Fig. 8-4)
	2007-4200-26	Recorder Assy, 230V, 50Hz (See Fig. 8-4)
2	888130	Case Assy, Recorder (See Fig. 8-2)
3	11-6402-14	Chart Takeup Assy (See Fig. 8-3)

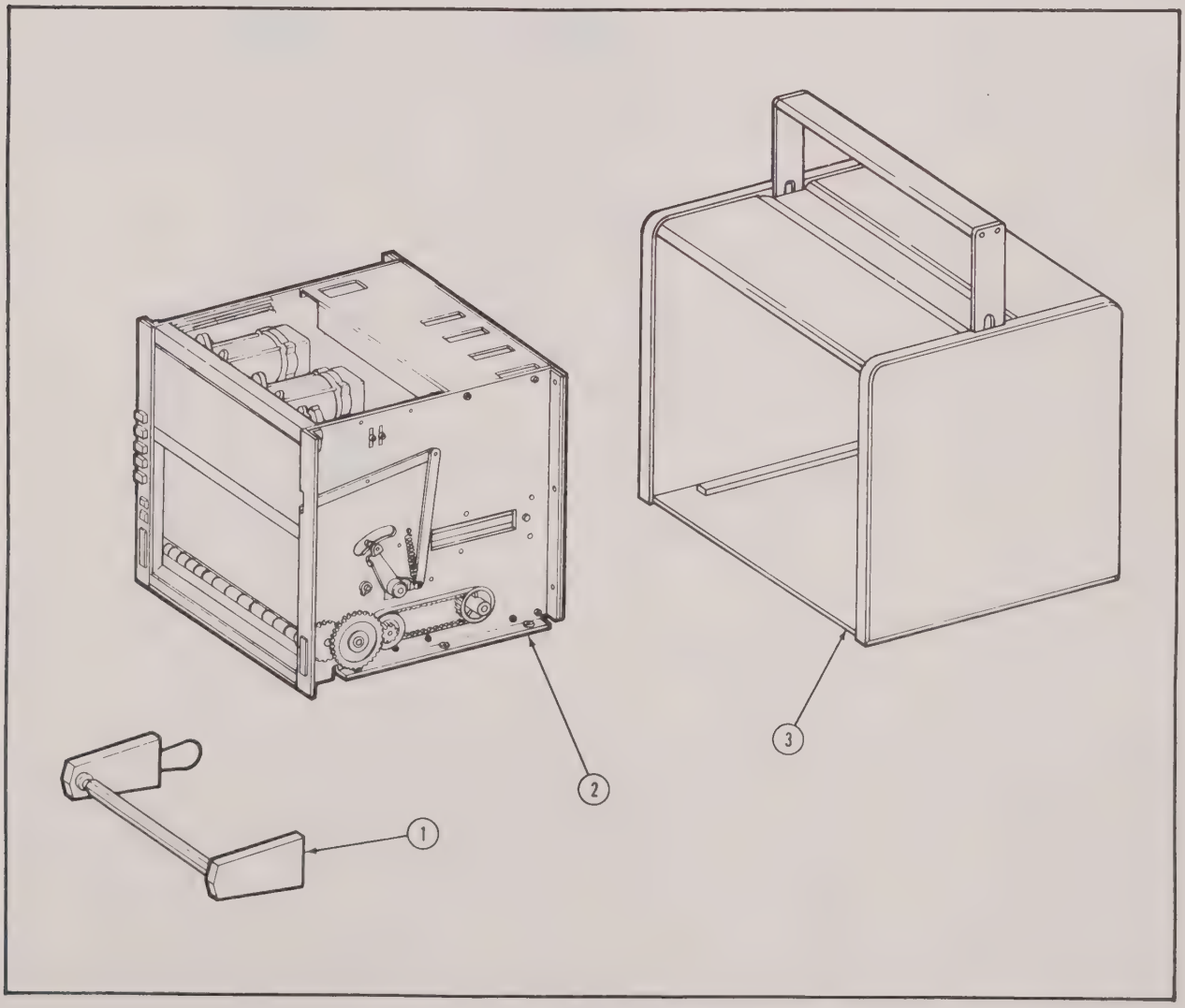


FIGURE 8-1 SURFANALYZER RECORDER

EXPLODED VIEW PARTS LIST
CASE ASSEMBLY
FIGURE 8-2

ITEM NO	PART NUMBER	DESCRIPTION
	888130	Case Assembly
1	483292	Panel, Side
2	788128-1	Handle Assy
3	688126-1	Cover, Center
4	286048	Support, Handle
5	488131-2	Guide, Left
6	488131-1	Guide, Right
7	688127-1	Cover, Front & Rear
8	1-232736-16	Tape, Teflon
9	4-266107-5	Bail Assy
10	488129	Saddle, Recorder
11	287185	Bar, Support

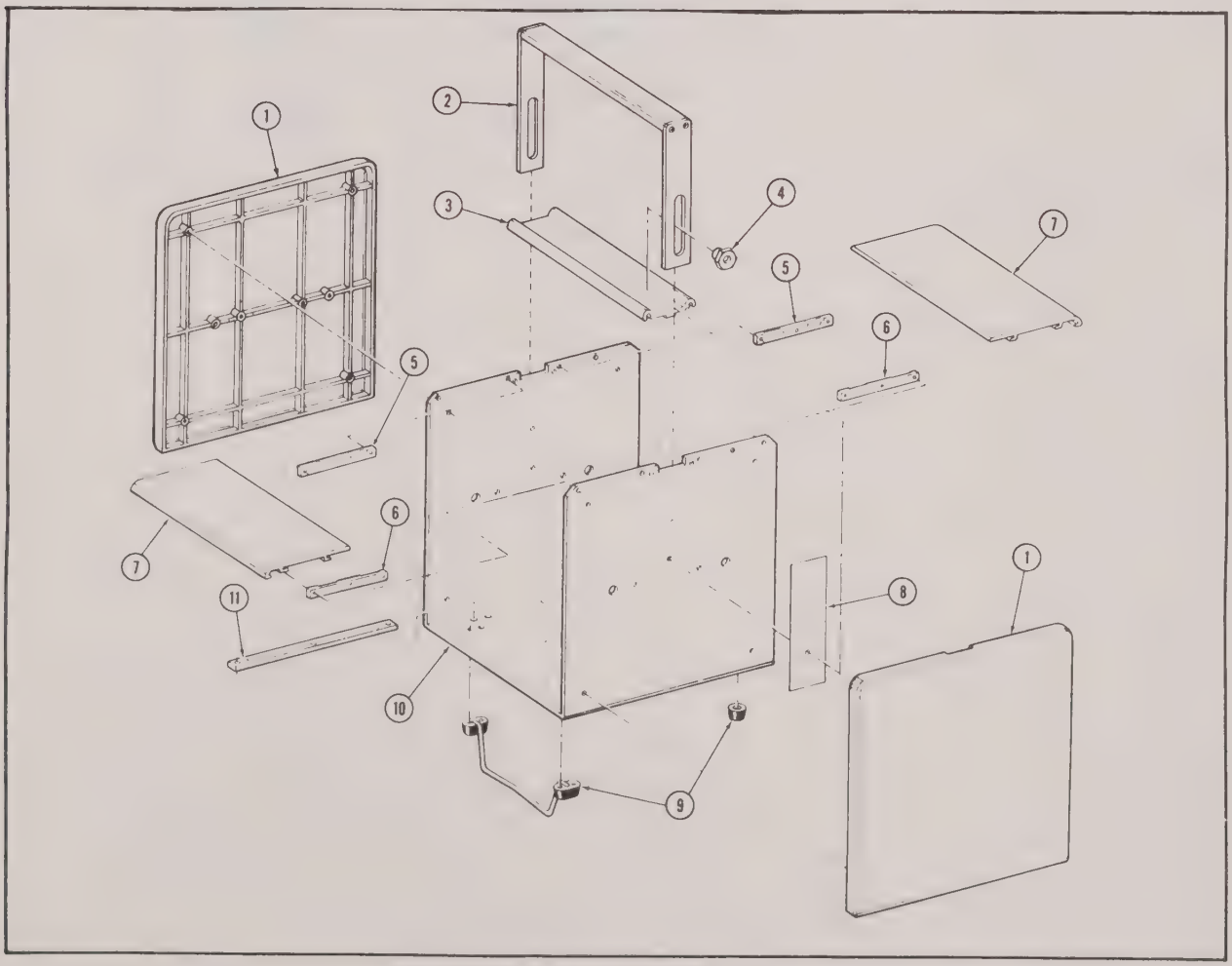


FIGURE 8-2 CASE ASSEMBLY

EXPLODED VIEW PARTS LIST
CHART TAKEUP ASSEMBLY 11-6402-14
FIGURE 8-3

ITEM NO	PART NUMBER	DESCRIPTION
1	249617-5	Plate, Cover - R.H.
2	243867-12	"O" Ring
3	246651	Roller, Guide
4	246307	Block
5	236865-3	Cotter Pin
6	266046	Pulley
7	767254-6	Arm Assembly, L.H.
8	9-249640-8206	Screw Fl. Hd.
9	686704	Shaft Assembly
10	247523-131	Plate, Ident. Mod. No.
11	767249-6	Arm, Right
12	249618-5	Plate Cover - L.H.
13	267253	Spring Compression
14	266184	Shaft, Shouldered
15	667251	Shaft Assembly, Shouldered
16	243696	Retainer, Bearing
17	267257	Pulley

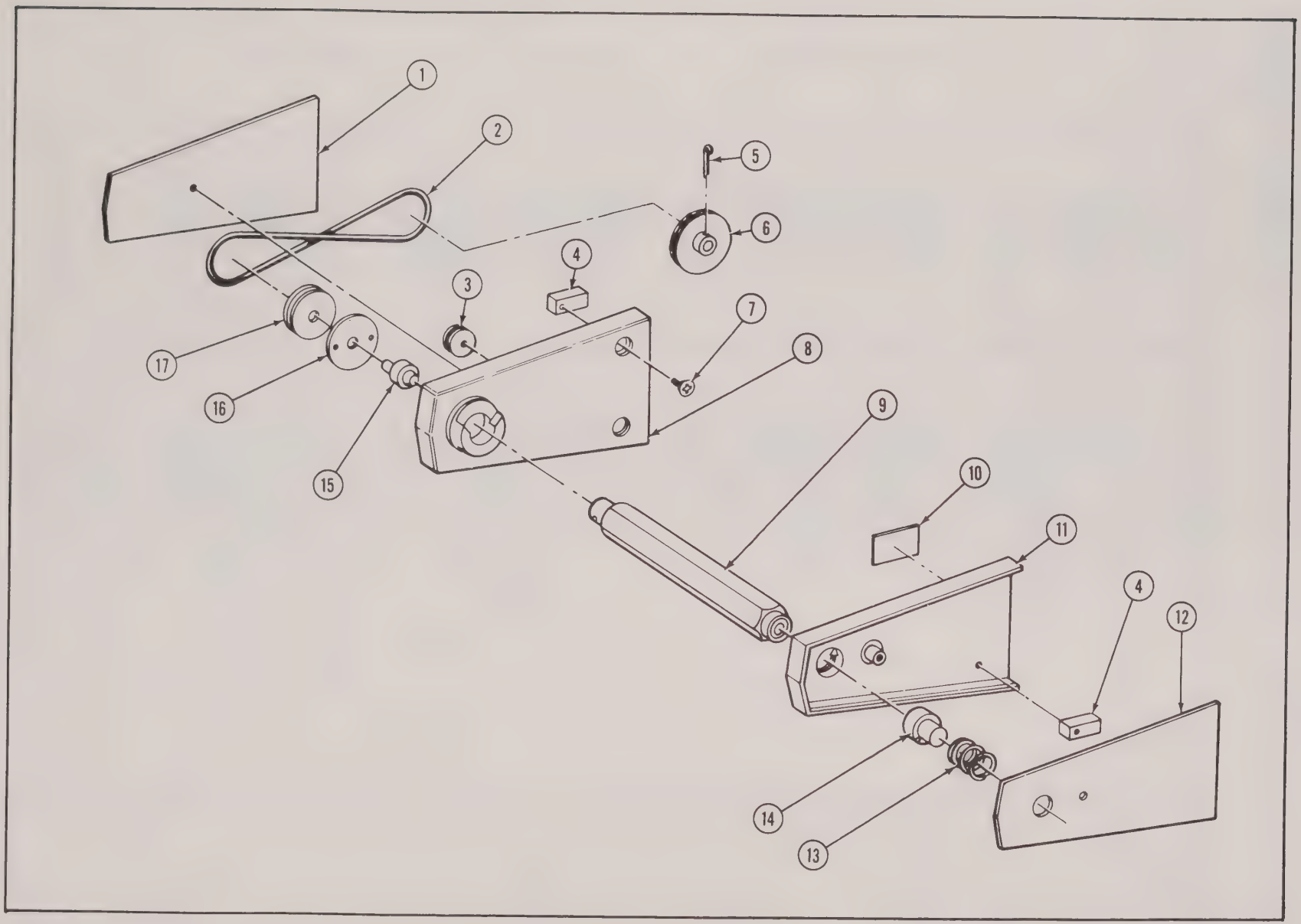


FIGURE 8-3 CHART TAKEUP ASSEMBLY

EXPLODED VIEW PARTS LIST
RECORDER SUBASSEMBLY
FIGURE 8-4

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	888420	Recorder, Sub-Assy	
1	285764-4	Lens	
2	285764-1	Lens	
3	784416	Panel Assy, Front L.H.	
		(Attaching Parts)	
	243898-02	Nut Assy	
		------ * ------	
4	285765-1	Lamp	DS-101, DS-102
5	685196-2	Lampholder Assy	
6	265745-1	Washer, Mylar	
7	265741-1	Bearing, Ball	
8	127271	Washer	
9	2-240731-10	Ring, Retaining	
10	685196-1	Lampholder Assy	
11	286767	Insulator	
12	888410	Board Assy, Switch (See Fig. 8-5)	A-110
		(Attaching Parts)	
	13-119918-4004	Screw	
	1-118195-304	Washer	
		------ * ------	
13	242461-45	Nut	
14	248169-2	Spacer	
15	11-2873-20	Pen Assy, Event	
16	667447-3	Tube	
17	888775	Event Marker Assy, L.H.	L-108
18	288429-1	Bracket	
		(Attaching Parts)	
	31-119920-2603	Screw	
	31-119918-8210	Screw	
	31-119998-82	Nut	
	1-216741-425	Lockwasher	
		------ * ------	
19	885098-1	Plate Assy, L.H. (See Fig. 8-6)	
20	11-2730-01	Ink Cartridge	
21	885090	Pen Assy, Analog	
22	687447-1	Ink Tube Assy	
23	785171	Bar Assy, Penmotor (see Fig. 8-7)	
		(Attaching Parts)	
	31-119922-8206	Screw, Cap	
	1-216741-425	Lockwasher	
		------ * ------	
24	788137	Door Assy	
		(Attaching Parts)	
	13-262716-6204	Screw	
		------ * ------	

EXPLODED VIEW PARTS LIST
RECORDER SUBASSEMBLY
FIGURE 8-4 (Continued)

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
25	386224	Slide	
26	285711	Spring	
27	886568	Manifold Assy (115V models) see Fig. 8-8)	
	886777	Manifold Assy (230V models) (See Fig. 8-8)	
		(Attaching Parts)	
	31-119922-8206	Screw, Cap	
	1-216741-425	Lockwasher	
		------ * ------	
28	386034	Shield	
		(Attaching Parts)	
	13-262716-4004	Screw	
		------ * ------	
29	886031	Bracket Assy, Bottom	
		(Attaching Parts)	
	13-262716-4006	Screw	
	31-126906-405	Screw	
		------ * ------	
30	888188	Board Assy, Control (see Fig. 8-9)	A-109
31	888261	Bracket Assy, Top	
		(Attaching Parts)	
	13-262716-4006	Screw	
	31-126906-405	Screw	
		------ * ------	
32	886220	Board Assy, Drive Amp (See Fig. 8-10)	A-101; A-102
33	888412	Board Assy, Input (See Fig. 8-11)	A-111
34	116198-X	Fuse (115V model) See Table 8-1 Fuse	
	266924-X	Fuse (230V model) Table following Fig. 8-4 parts list.	
35	286027	Panel, Filler	
		(Attaching Parts)	
	31-119918-4006	Screw	
	1-120053-201	Lockwasher	
		------ * ------	
36	384419	Cover, Rear	
		(Attaching Parts)	
	13-262716-4004	Screw	
	1-216741-411	Lockwasher	
		------ * ------	
37	886667	Bracket Assy, Shield (60Hz) (See Fig. 8-12)	
	886921	Bracket Assy, Shield (50Hz) (See Fig. 8-12)	
		(Attaching Parts)	
	13-262716-4004	Screw	
		------ * ------	

EXPLODED VIEW PARTS LIST
RECORDER SUBASSEMBLY
FIGURE 8-4 (Continued)

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
38	785087	Harness Assy, Penmotor	
	9-281501-82	Connector	XM101 & XM102
	281506-1	Contact, Elec	
	1-283408-2	Contact, Elec	
39	888277	Harness Assy (see Fig. 8-13)	
		(Attaching Parts)	
	13-262716-4008	Screw	
		----- * -----	
40	885083-3	Plate Assy, R.H. (See Fig. 8-14)	
41	1-286404-1	Motor, Fan 115V /50-60Hz)	B-102
	1-286404-2	Motor, Fan 230V/50Hz	B-102
		(Attaching Parts)	
	31-119998-40	Nut	
	31-119918-4006	Screw	
	13-262716-4004	Screw	
	1-216741-411	Lockwasher	
		----- * -----	
42	265840-2	Lug, Terminal	
43	786030	Cover Assy, Rear	
		(Attaching Parts)	
	13-262716-4004	Screw	
	1-216741-411	Lockwasher	
		----- * -----	
44	243542-6	Belt, Timing	
45	385806	Pulley	
		(Attaching Parts)	
	14-119923-6203	Set Screw	
		----- * -----	
46	286531	Spring	
47	686429	Indicator Assy	
48	286592	Spring	
49	1-227070-3	Ring, Retaining	
50	683485	Brake Assy (see Fig. 8-15)	
		(Attaching Parts)	
	14-119923-0204	Set Screw	
		----- * -----	
51	385710	Gear, Pulley	
52	285511-6	Washer, Shim	
53	1-227070-9	Ring, Retaining	
54	269491	Gear, Dual	
55	269499	Gear, Spur	
56	1-227070-9	Ring, Retaining	
57	288429	Bracket	
58	887715	Event Marker Assy, R.H.	L-109
		(Attaching Parts)	

EXPLODED VIEW PARTS LIST
RECORDER SUBASSEMBLY
FIGURE 8-4 (Continued)

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	31-119920-2603	Screw	
	31-119918-8210	Screw	
	31-119998-82	Nut	
	1-216741-425	Lockwasher	
		------ * ------	
59	685719	Roll, Drive	
60	241513-206	Capacitor, 115V	C-108
	231449-27	Capacitor, 230V	C-108
61	265840-1	Lug, Terminal	
62	786570-2	Chassis Assy, 115V/60Hz (see Fig. 8-16)	
	786895-2	Chassis Assy, 230V/50Hz (see Fig. 8-16)	
		(Attaching Parts)	
	13-262716-8206	Screw	
		------ * ------	
63	784418	Panel Assy, Front R.H.	
		(Attaching Parts)	
	243898-02	Nut Assy	
		------ * ------	
64	246388	Cover, Panel	
65	785701-1	Chute, Paper	
		(Attaching Parts)	
	13-262716-8206	Screw	
		------ * ------	
66	267426-1	Paper Deflector	
67	888183	Table Assy, Writing (see Fig. 8-18)	
68	785718	Flange Assy, Supply	
69	785745	Shaft Assy, Supply	
70	285357-1	Shaft	
71	783590	Sensor Assy (see Fig. 8-19)	

TABLE 8-1 FUSE TABLE (ITEM 34)

FUSE SYMBOL	LINE VOLTAGE & FREQUENCY	
	115V/60HZ	230V/50HZ
F101, F102	116198-9 3/4A, 125V	266924-7 1/2A, 250V
F109	116198-6 1/4A, 125V	266924-2 1/4A, 250V
F110	116198-6 1/4A, 125V	266924-4 1/8A, 250V
F111 W/1-Ink Solenoids	116198-6 1/4A, 125V	266924-4 1/8A, 250V
F112	116198-11 1.5A, 125V	266924-6 3/4A, 250V

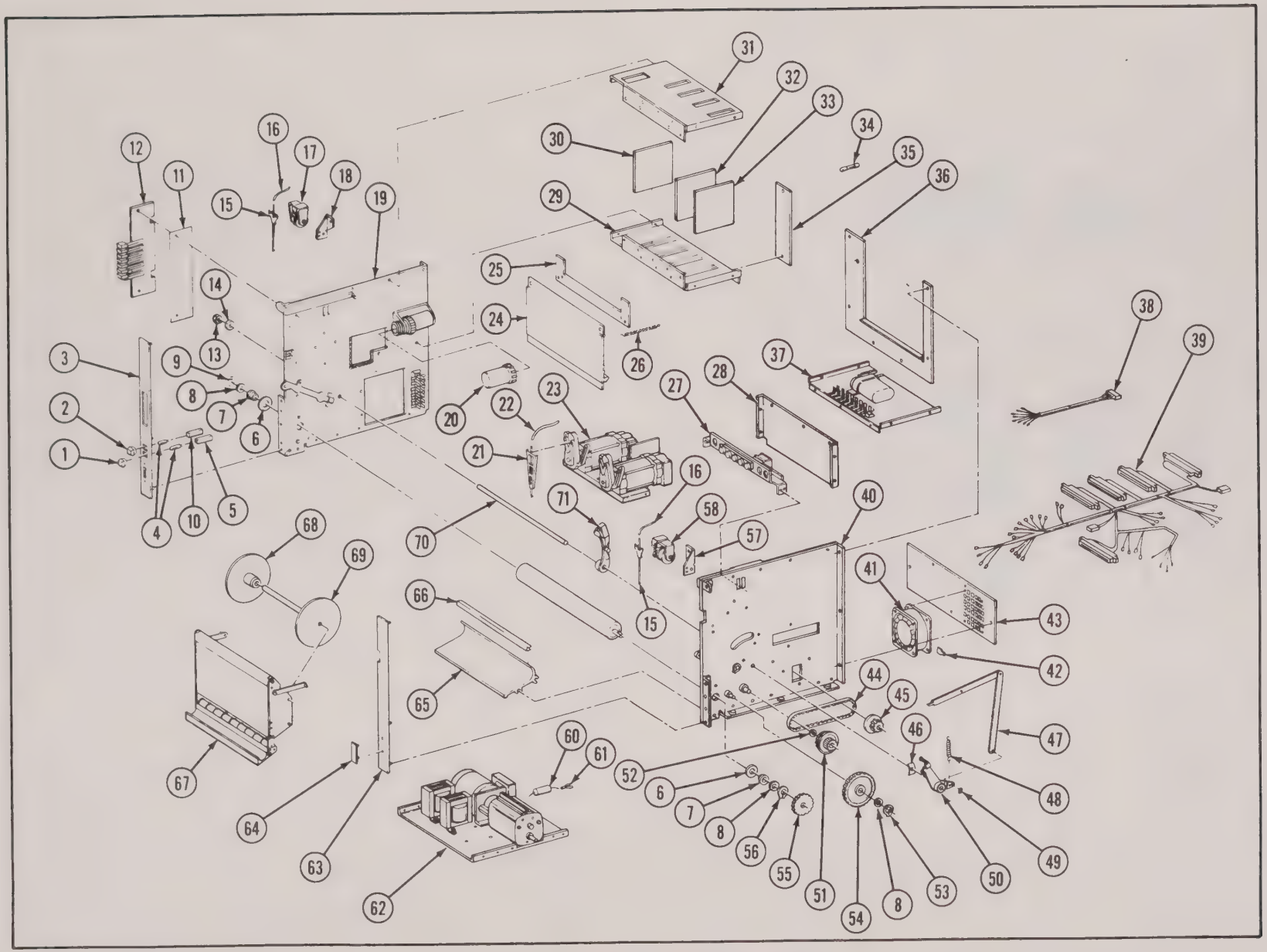


FIGURE 8-4 RECORDER SUBASSEMBLY

EXPLODED VIEW PARTS LIST
BOARD ASSEMBLY, SWITCH
FIGURE 8-5

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	888410	Board Assy, Switch	
1	488259	Board Printed Circuit	
2	288064	Switch Speed Select	S-101
3	265763-3	Contact	E-1 thru E-4
4	688377-1	Button, Switch – "STOP"	
5	688377-2	Button, Switch – "2.5"	
6	688377-3	Button, Switch – "5"	
7	688377-4	Button, Switch – "12.5"	
8	688377-5	Button, Switch – "25"	
9	688377-6	Button, Switch – "50"	
10	688377-7	Button, Switch – "125"	

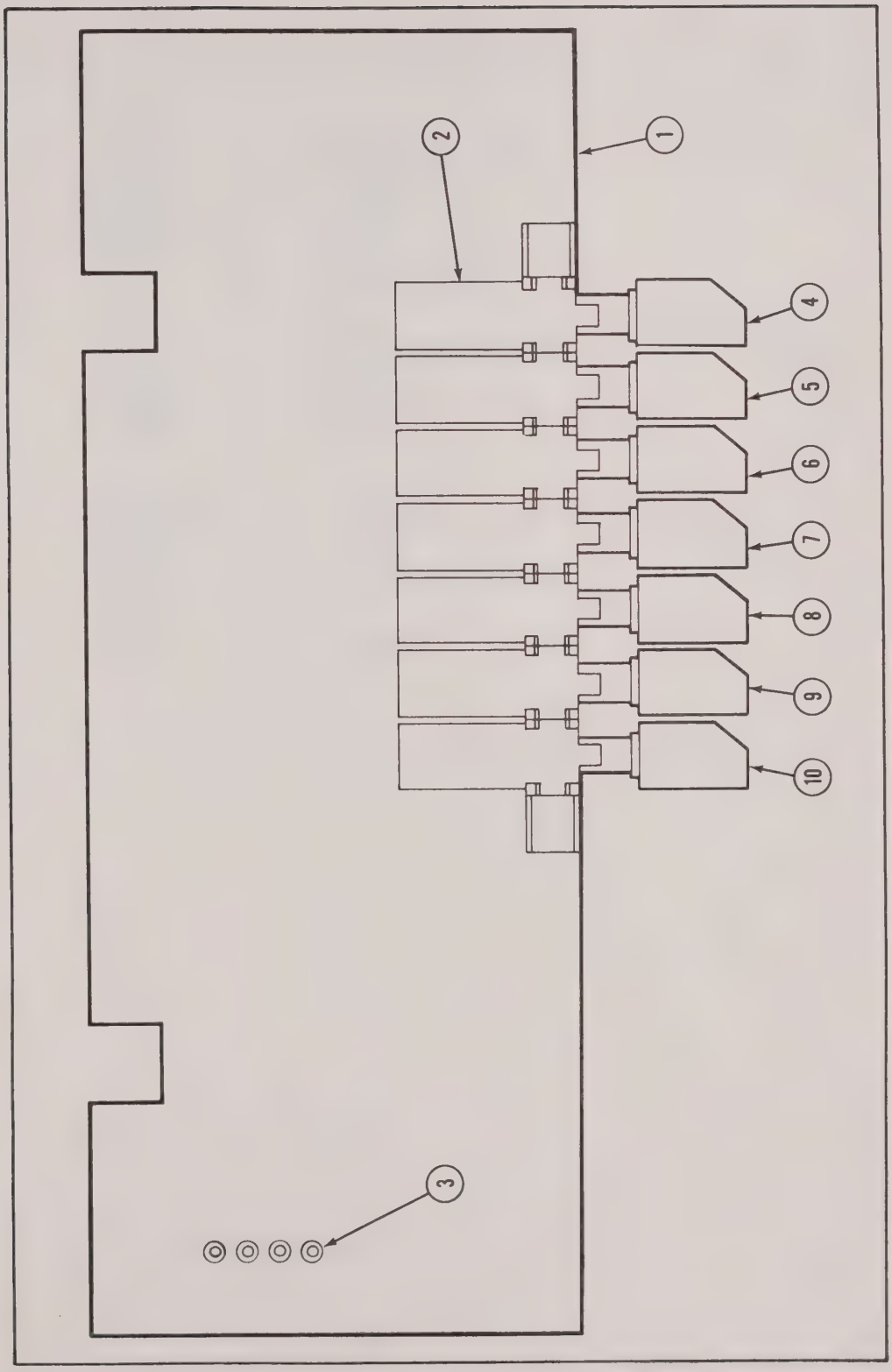


FIGURE 8-5 SWITCHBOARD ASSEMBLY

EXPLODED VIEW PARTS LIST
PLATE ASSEMBLY L.H.
FIGURE 8-6

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	885098-1	Plate Assembly, L.H.	
1	885046	Plate Subassy	
2	1-265849-4	Bracket	
3	385543-2	Guide	
4	385619	Bracket, Connector	
5	766243	Ink Plunger Assy	
6	286015-1	Filter	FL-101
7	265814-6	Terminal Board	TB-102
8	285929	Bracket, L.H.	
9	2-128693-3	Grommet	
10	243623	Spring	
11	243622	Pad, Friction	
12	243611-910	Lever Assy	
13	127271	Washer	
14	1-227070-9	Ring, Retaining	
15	285599	Catch	
16	243440	Bumper	
17	265711	Catch	

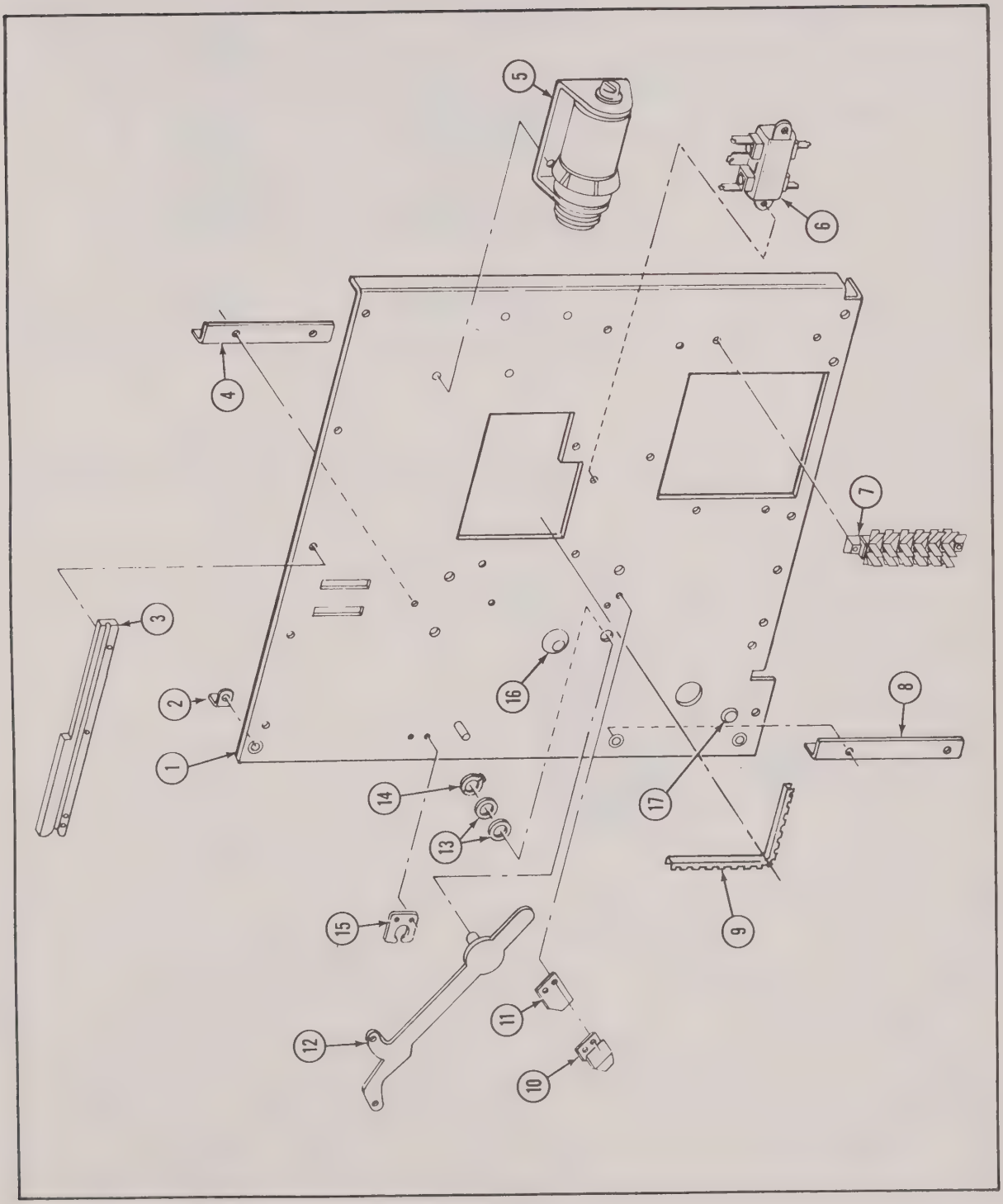


FIGURE 8-6 L.H. PLATE ASSEMBLY

EXPLODED VIEW PARTS LIST
BAR ASSEMBLY, PENMOTOR
FIGURE 8-7

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	785171	Bar Assy, Penmotor - 2 Channel	
1	884320	Penmotor Assembly	M-101—102
2	684999	Band, Penmotor (Part of Item 1)	
		(Attaching Parts)	
	1-265424-09010	Screw	
	265424-09008	Screw, Extrusion	
		------ * ------	
3	385704	Bar, Penmotor	
4	684853	Saddle, Penmotor	

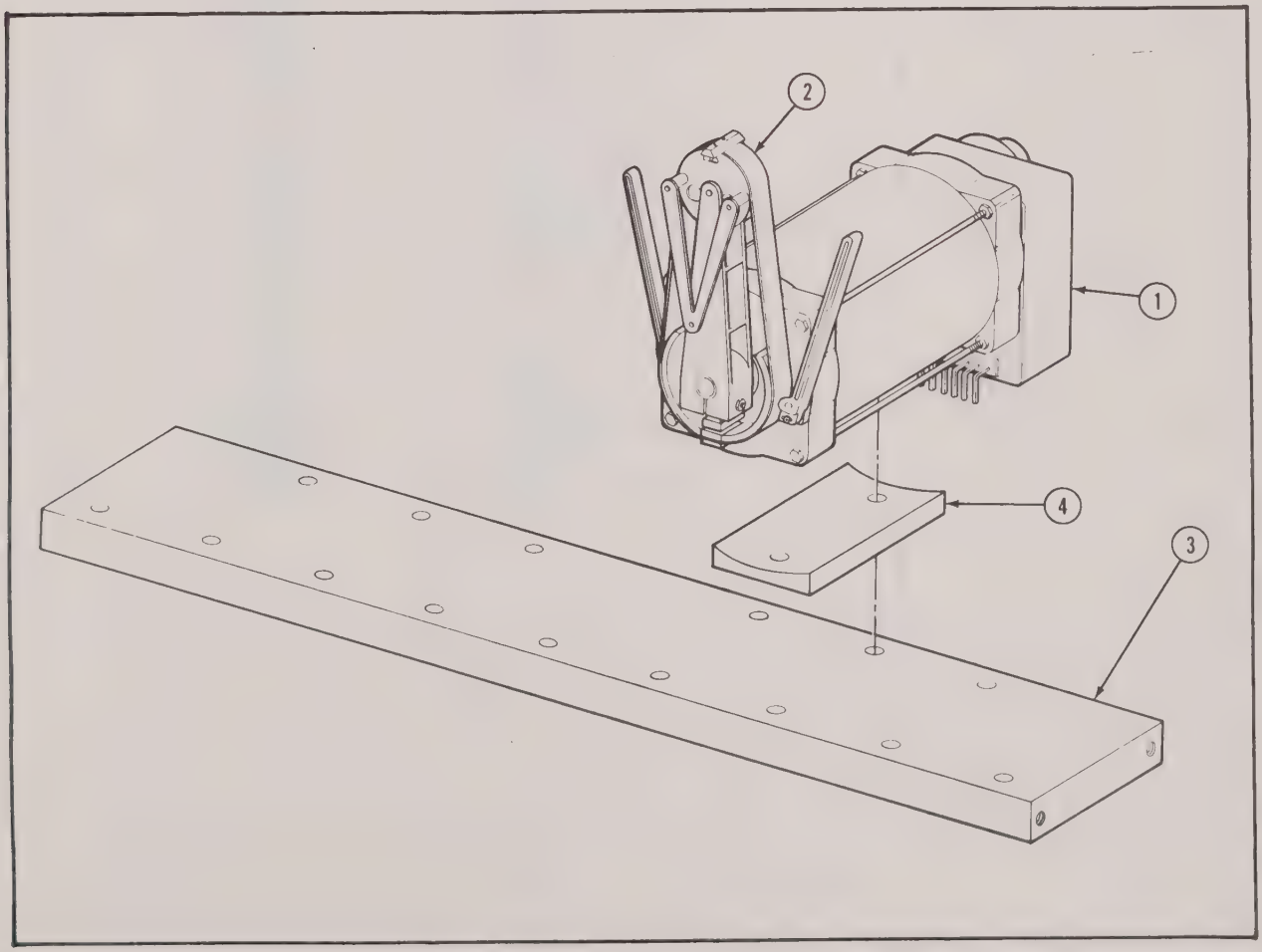


FIGURE 8-7 BAR ASSEMBLY, PENMOTOR

EXPLODED VIEW PARTS LIST
MANIFOLD ASSEMBLY
FIGURE 8-8

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	886568	Manifold Assembly, 115V	
	886777	Manifold Assembly, 230V	
	684169	Valve Assembly	
1	267753	Support	
2	667885	Tube Assy	
3	467355-2	Retainer, Diaphragm	
4	267858	Diaphragm	
5	467355-3	Piston	
6	467355	Retainer, "O" Ring	
7	232780-1	"O" Ring	
8	241639	Ball	
9	267353	Spring	
10	365993	Housing, Valve	
11	286432	Link	
12	236865-2	Cotter Pin	
13	686530-1	Lever	
14	265989	Shaft	
15	269683	Spring	
16	467355-5	Screw, Operator	
17	467355-6	Knob, Ink Control	
18	249360	Cap, Ink Outlet	
19	486032	Bracket, Manifold Mounting	
20	686076	Supply Manifold Assy	
21	666582-2	Tube	
22	269549	Spring, Compression	
23	269256-7	Diode	CR-111
24	266888-2	Solenoid, 115V	L-105
	266888-3	Solenoid, 230V	L-105
25	236865-3	Cotter Pin	
26	286092	Bracket, Support	

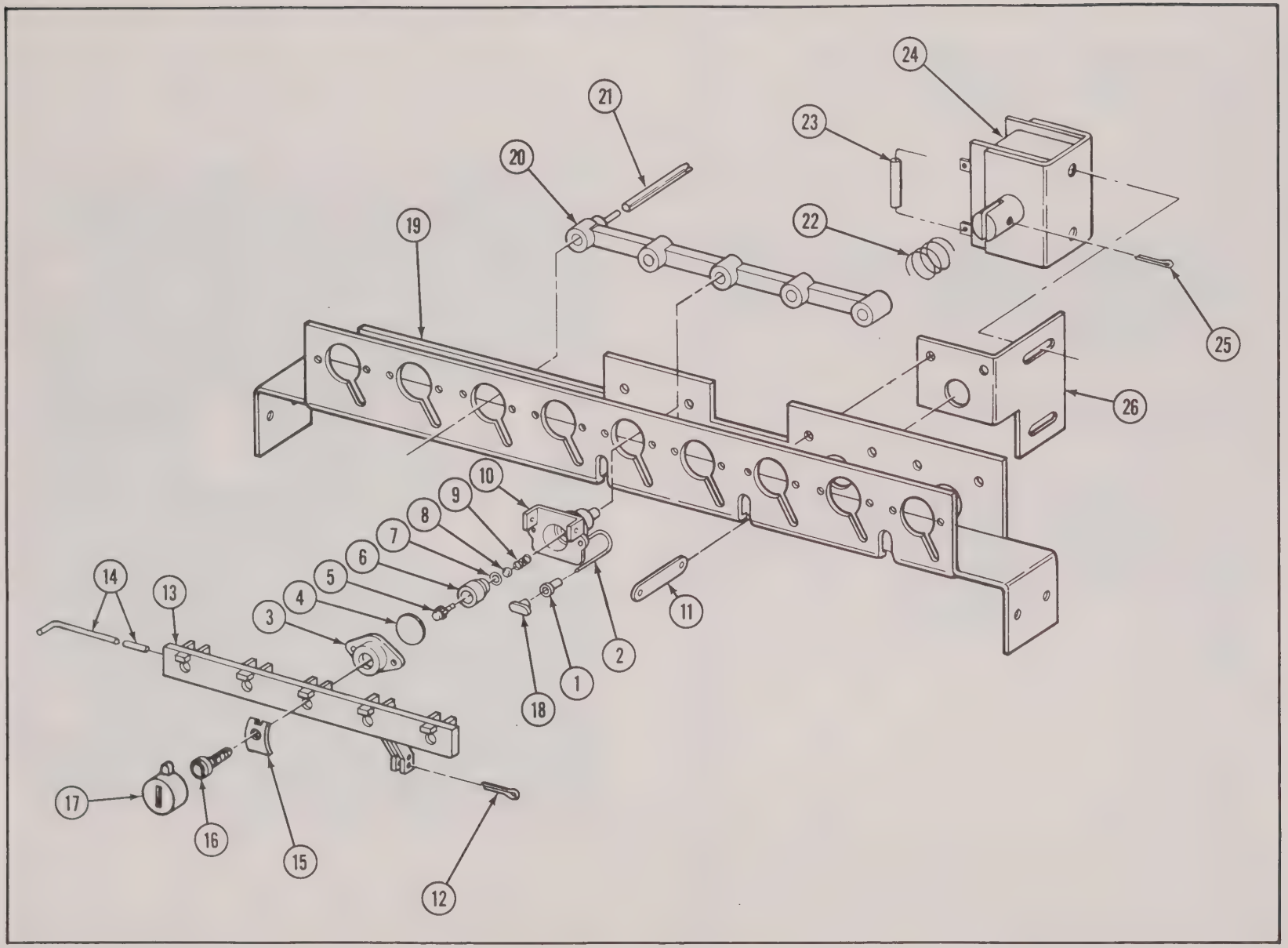


FIGURE 8-8 MANIFOLD ASSEMBLY

ELECTRICAL PARTS LIST
BOARD ASSY, CONTROL 888188
FIGURE 8-9

SYMBOL NO	PART NUMBER	DESCRIPTION
C-101	243037-507	Capacitor
C-102	243037-507	Capacitor
C-103	262585-106	Capacitor
C-106	230098-104	Capacitor
CR-101	286018-2	Diode, MDA104
CR-102	286018-1	Diode, MDA101
CR-103	286018-1	Diode, MDA101
CR-104	269256-7	Diode, IN 4007
CR-105	269256-7	Diode, IN 4007
CR-106	269256-7	Diode, IN 4007
K-101	285771-24	Relay
U-101	285317	Voltage Regulator
	265763-3	Contact
	688254	Heatsink
	285577	Fuse Clip

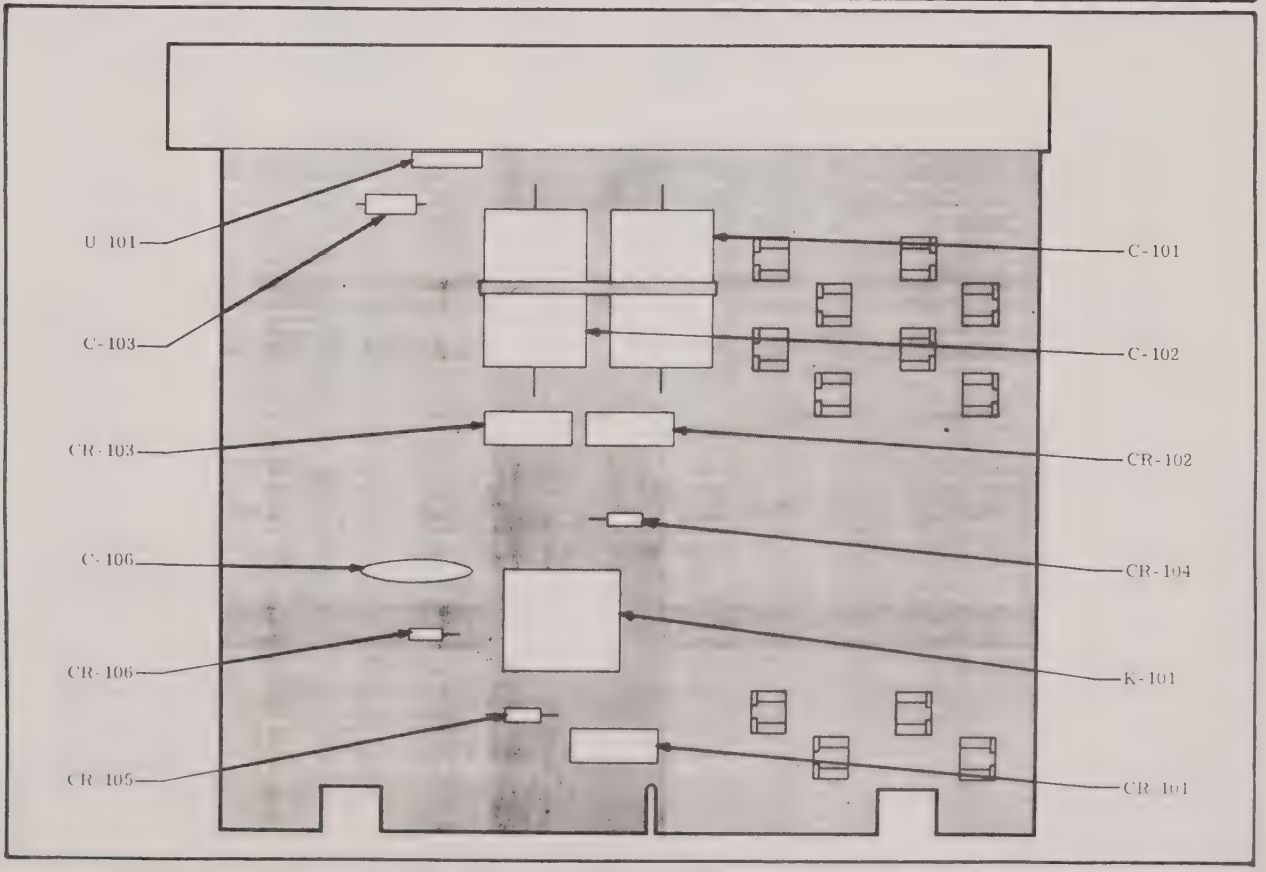


FIGURE 8-9 CONTROL TIMER BOARD ASSEMBLY

ELECTRICAL PARTS LIST
BOARD ASSEMBLY, DRIVE AMPLIFIER – 886220
FIGURE 8-10

SYMBOL NO	PART NUMBER	DESCRIPTION
C201	10-125904-223	Capacitor
C202	10-247116-102	Capacitor
C203, 204	10-247116-103	Capacitor
C205	240352-501	Capacitor
C206	10-247116-103	Capacitor
C207	240352-501	Capacitor
C208	262585-106	Capacitor
C209	10-247116-103	Capacitor
C210, 211	10-247116-102	Capacitor
C212	240352-202	Capacitor
C213	10-125904-503	Capacitor
C214	10-125904-223	Capacitor
C215	281509-507	Capacitor
C216	262585-106	Capacitor
C217	281509-507	Capacitor
C218	262585-106	Capacitor
C219-222	286010-108	Capacitor
CR201, 202	263727	Diode, 1N961B
CR203-208	270508	Diode, 1N4454
CR209, 210	286018-1	Diode, MDA-101
CR211	269256-7	Diode, 1N4007
Q201	286143	Transistor, 2N3906
Q202-205	286141	Transistor, 2N3904
Q206	1-230057-3	Transistor, 2N4923
Q207	1-286145-1	Transistor, 2N5982
Q208	1-230058-3	Transistor, 2N4920
Q209	1-286147-1	Transistor, 2N5985
Q210	281857-2	Transistor, 2N5033
R201	1-281851-30002	Resistor
R202	1-281851-10002	Resistor
R203	1-281851-43201	Resistor
R204	1-281851-10002	Resistor
R205	282299-103	Resistor
R206, 207	1-281851-69000	Resistor
R208	282299-103	Resistor
R209	282299-202	Resistor
R210	1-281851-200R0	Resistor
R211	1-281851-10002	Resistor
R212, 213	1-281851-10001	Resistor
R214	1-281851-16601	Resistor

ELECTRICAL PARTS LIST
BOARD ASSEMBLY, DRIVE AMPLIFIER – 886220
FIGURE 8-10 (Continued)

SYMBOL NO	PART NUMBER	DESCRIPTION
R215, 216	1-281851-10000	Resistor
R217, 218	1-281851-80000	Resistor
R219	1-281851-72001	
R220	1-281851-40000	Resistor
R221	1-281851-80001	Resistor
R222	1-281851-40001	Resistor
R223, 224	5-241111-622	Resistor
R225	5-241111-392	Resistor
R226, 227	1-281851-50001	Resistor
R228	1-281851-10002	Resistor
R229	1-281851-60001	Resistor
R230	1-281851-60000	Resistor
R231	282299-502	Resistor
R232	1-281851-500R0	Resistor
R233	1-281851-10003	Resistor
R234	1-281851-26501	Resistor
R235	5-241111-104	Resistor
R236	5-241111-203	Resistor
R237	5-241111-822	Resistor
R238	5-241111-102	Resistor
R239, 240	5-241111-202	Resistor
R241	5-241111-391	Resistor
R242	5-241111-102	Resistor
R243	5-286587-181	Resistor
R244	5-283654-220	Resistor
R245	5-286587-181	Resistor
R246	5-241111-102	Resistor
R247	1-281851-20001	Resistor
R248	1-281851-500R0	Resistor
R249, 250	1-281851-80000	Resistor
R251	5-241111-104	Resistor
R252, 253	5-241111-103	Resistor
R254	1-281851-16001	Resistor
R255	1-281851-50000	Resistor
R256	5-241111-101	Resistor
R257	1-281851-20001	Resistor
R258, 259	1-281851-10002	Resistor
R260	282299-103	Resistor
R261	1-281851-15301	Resistor
R262	5-241111-104	Resistor
R263, 264	5-130340-2R0	Resistor
R265	5-241111-822	Resistor

ELECTRICAL PARTS LIST
BOARD ASSEMBLY, DRIVE AMPLIFIER – 886220
FIGURE 8-10 (Continued)

SYMBOL NO	PART NUMBER	DESCRIPTION
U201-204	280863-3	Integrated Circuit, 741C
U205	269941-1	Integrated Circuit, 1439G
U206	280863-3	Integrated Circuit, 741C
U207	285461	Voltage Reg., MC 7815
U208	285778	Voltage Reg., MC 7915
U209, 210	Not Used	
U211	285589	Isolator, LED, 4N28
---	686391	Heatsink (Rectangular black object top of view)
---	685187	Jack Assembly (Not shown, mounted on heatsink)
J201	285315	Jack (large)
J202	267377	Jack (small)
*P201	114816-15	Plug (mates with J201)
*P202	267379	Plug (mates with J202)

*Shipped loose.

FIGURE 8-10 DRIVE AMPLIFIER ASSEMBLY (Sheet 1 of 2)

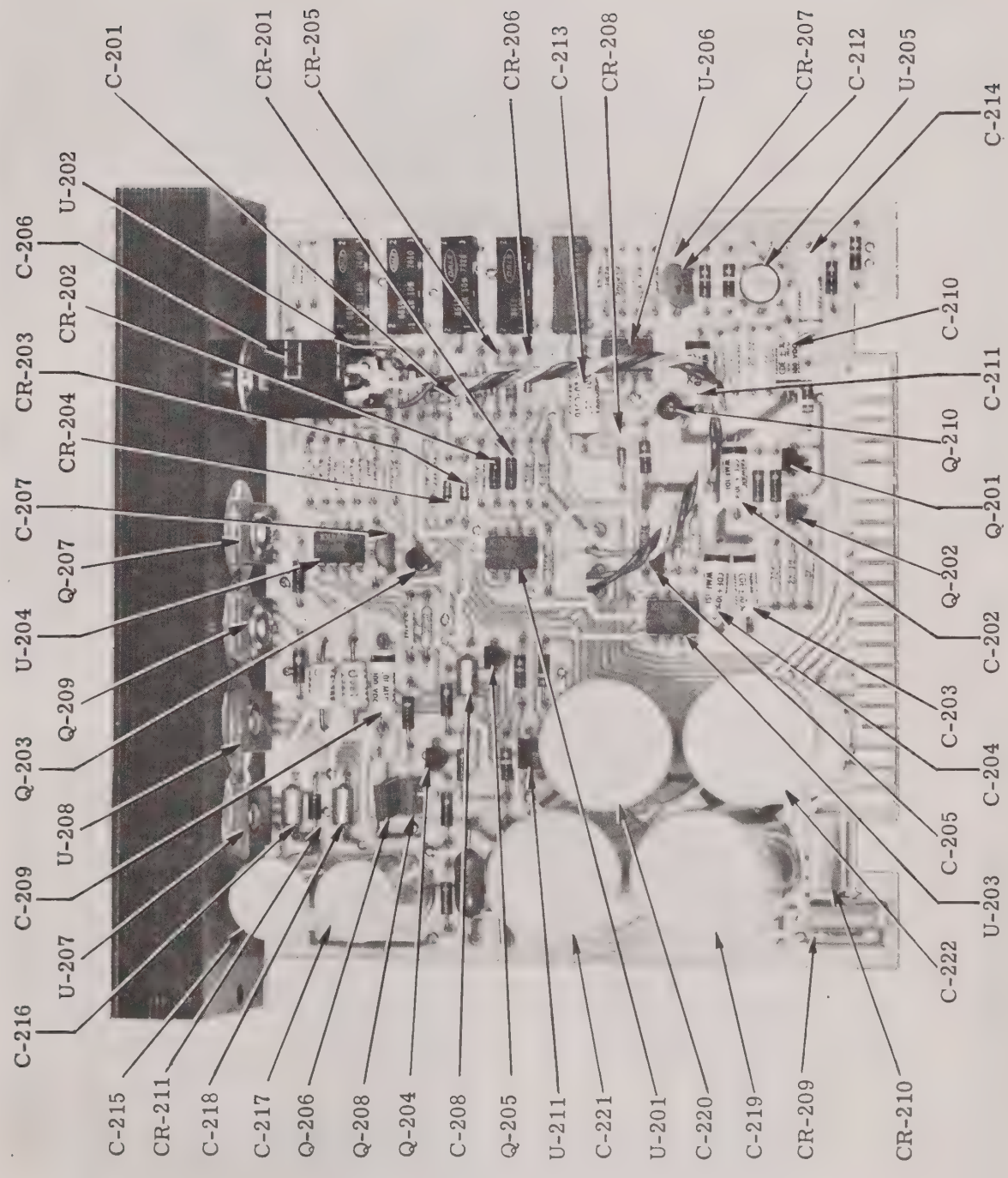


FIGURE 8-10 DRIVE AMPLIFIER ASSEMBLY (Sheet 2 of 2)

ELECTRICAL PARTS LIST
INPUT BOARD ASSY 88412
FIGURE 8-11

SYMBOL NO	PART NUMBER	DESCRIPTION
R-101	282299-503	Resistor, Vari
R-102	282299-503	Resistor, Vari
R-103	282299-503	Resistor, Vari
R-104	282299-503	Resistor, Vari
K-102	287725	Relay
---	265763-3	Contact
---	688252	Heat Sink
---	263806-4	Hardware, Conn Mtg.
---	788266	Harness Assy
	*265760-1	Contact
	*266592-2	Contact
J-105	*861775-299	Cable Assy
	*266592-1	Connector

* Part of Harness Assy 788266

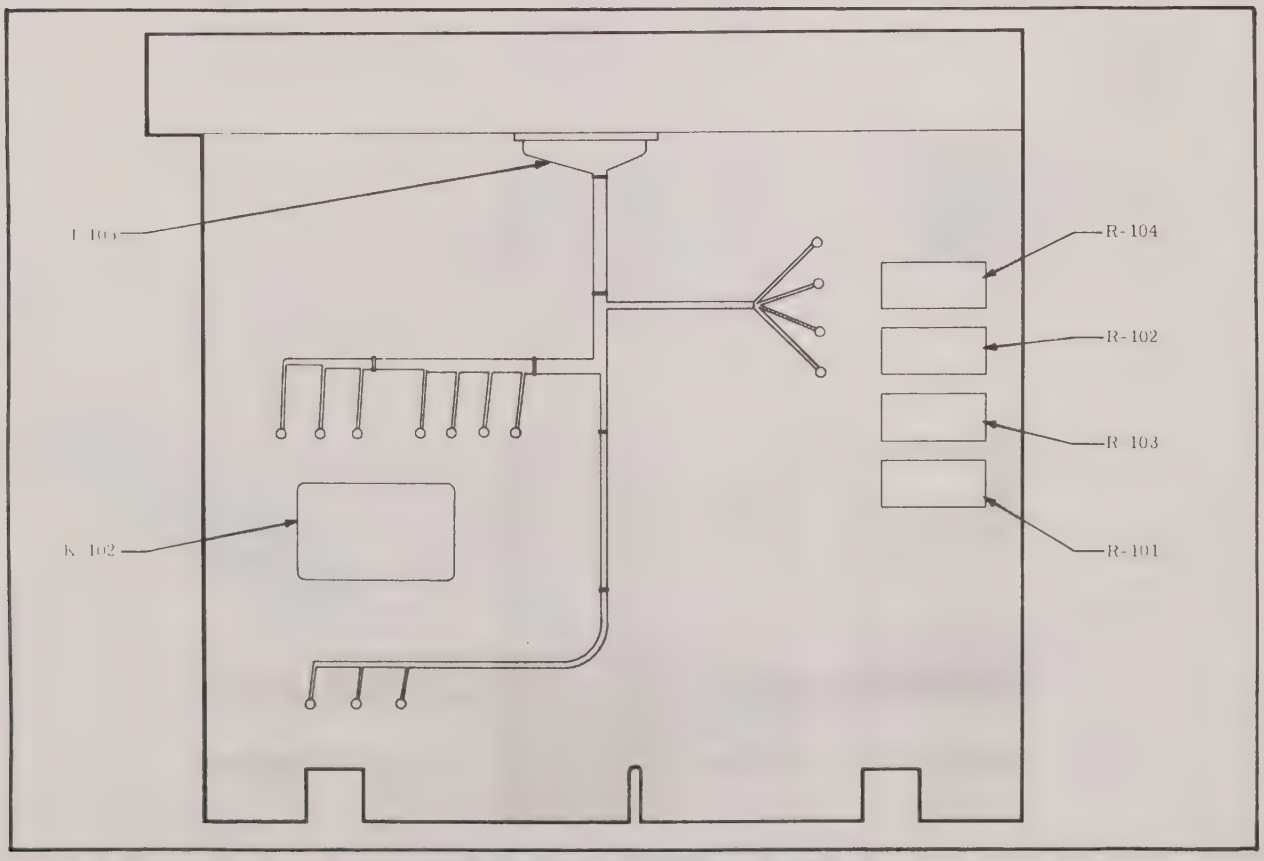


FIGURE 8-11 INPUT BOARD ASSEMBLY

EXPLODED VIEW PARTS LIST
BRACKET ASSEMBLY, SHIELD
FIGURE 8-12

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO	USED ON
	886667	Bracket Assy, Shield		60Hz
	886921	Bracket Assy, Shield		50Hz
1	263394-1	Clamp, Capacitor		
2	1-263395-405	Capacitor, 4ufd	C-106	60Hz Models
	1-263395-505	Capacitor, 5ufd	C-106	50Hz Models
3	2-128693-1	Grommet, Catapillar		
4	386029	Bracket, Shield		50/60Hz Models
5	265814-15	Terminal Board, Q.D.	TB-103	

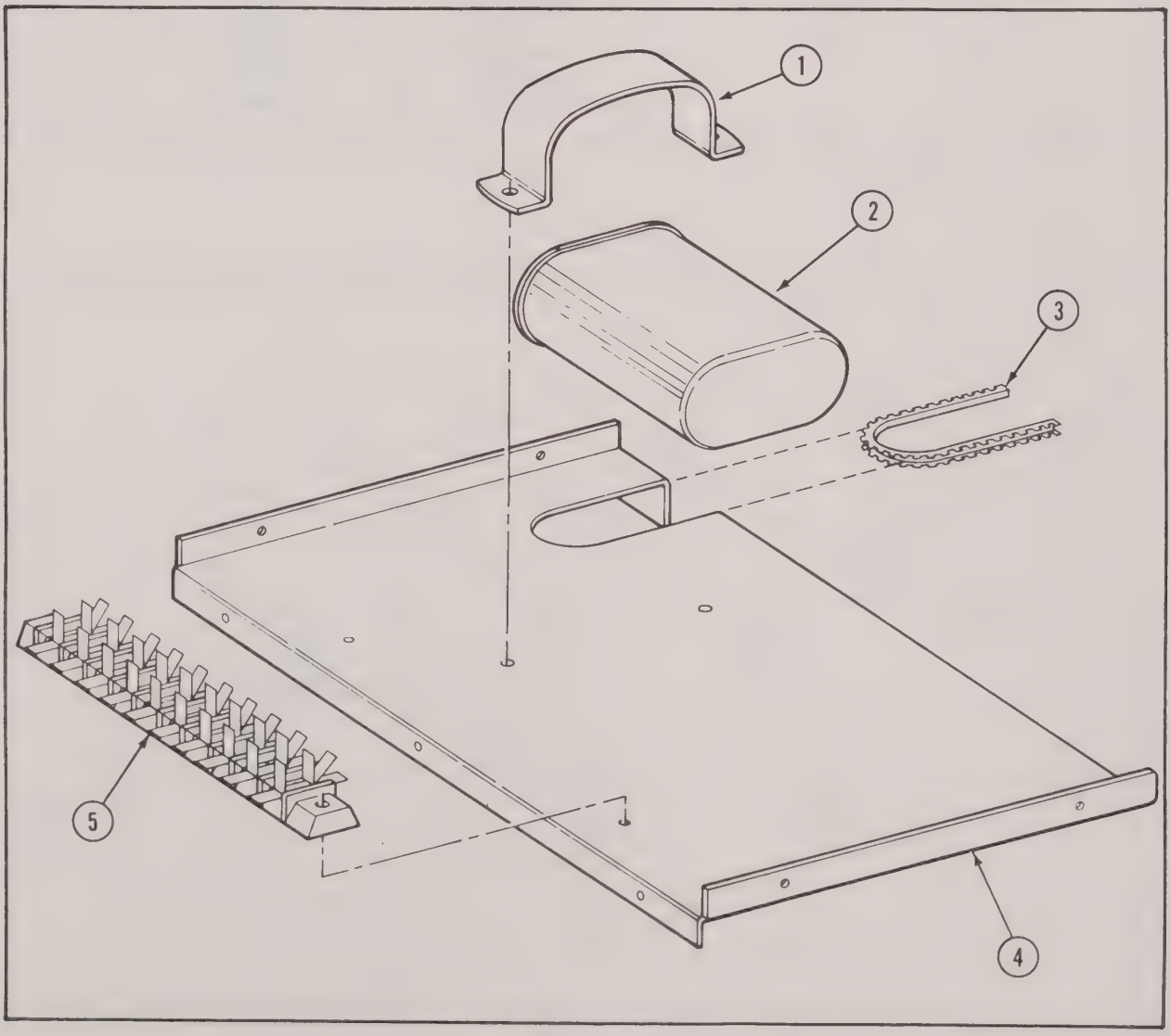


FIGURE 8-12 BRACKET ASSEMBLY, SHIELD

EXPLODED VIEW PARTS LIST
HARNESS ASSY 888277
FIGURE 8-13

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	888277	Harness Assy	
1	265840-1	Terminal Lug	
2	270160-1	Terminal Lug	
3	283420-44	Connector	XA-101,XA-103, XA-109 & XA-110 & XA-111
4	284700	Key, Polarizing	
5	286598	Common Spring	
6	9-270159-2	Connector	P-105 & P-106
7	265915-1	Terminal Lug	
8	265760-1	Contact	
9	1-283408-2	Contact	
10	270154-1	Contact	
11	232997-23	Strap, Retaining	

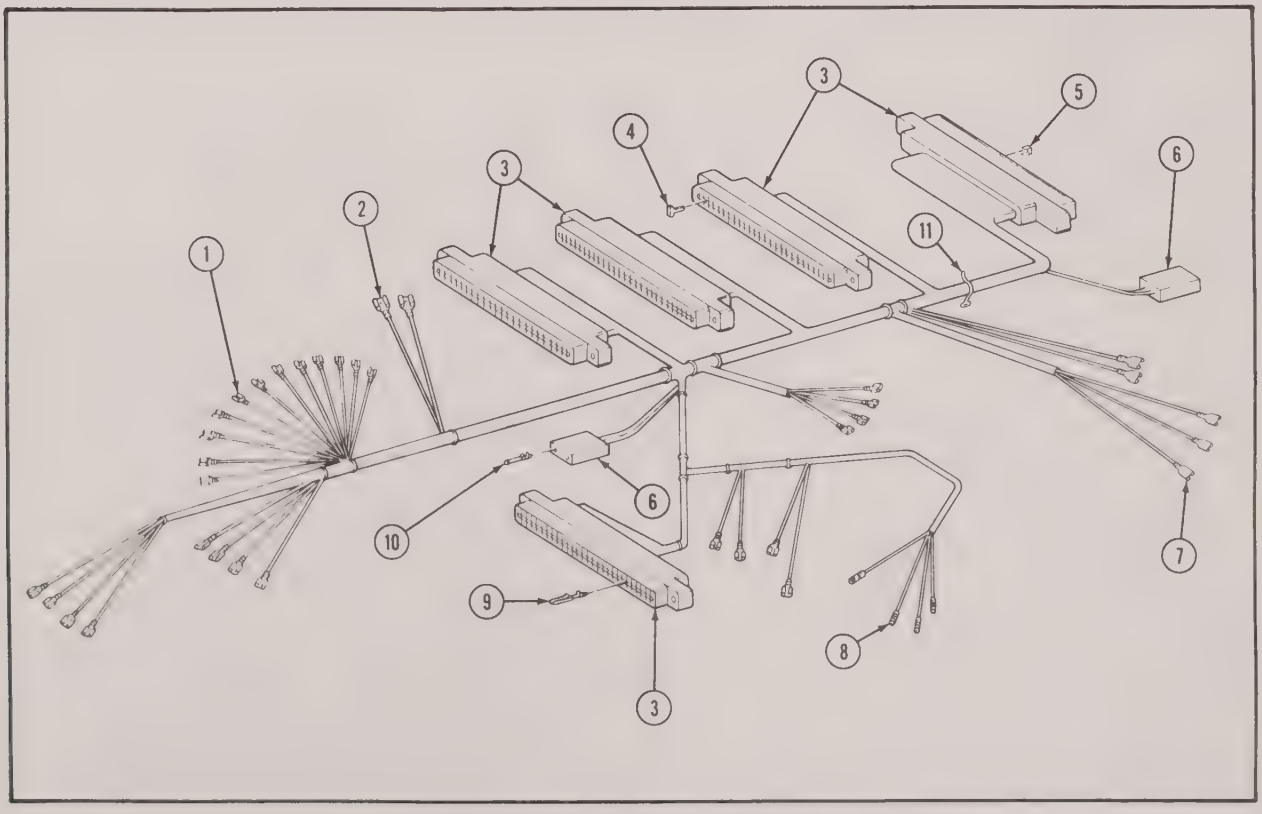


FIGURE 8-13 HARNESS ASSEMBLY

EXPLODED VIEW PARTS LIST
PLATE ASSEMBLY, R.H.
FIGURE 8-14

ITEM NO	PART NUMBER	DESCRIPTION
	885083-3	Plate Assembly, R.H.
1	385543-1	Guide
2	886560	Plate Subassy
3	286186	Shaft
4	286184	Shaft
5	285712	Bracket, R.H.
6	265711	Catch
7	1-227070-9	Ring, Retaining
8	127271	Washer
9	243898-62	Nut Assy
10	243622	Pad, Friction
11	243623	Spring
12	665789	Lever Assy, R.H.
13	285599	Catch
14	1-265849-4	Bracket

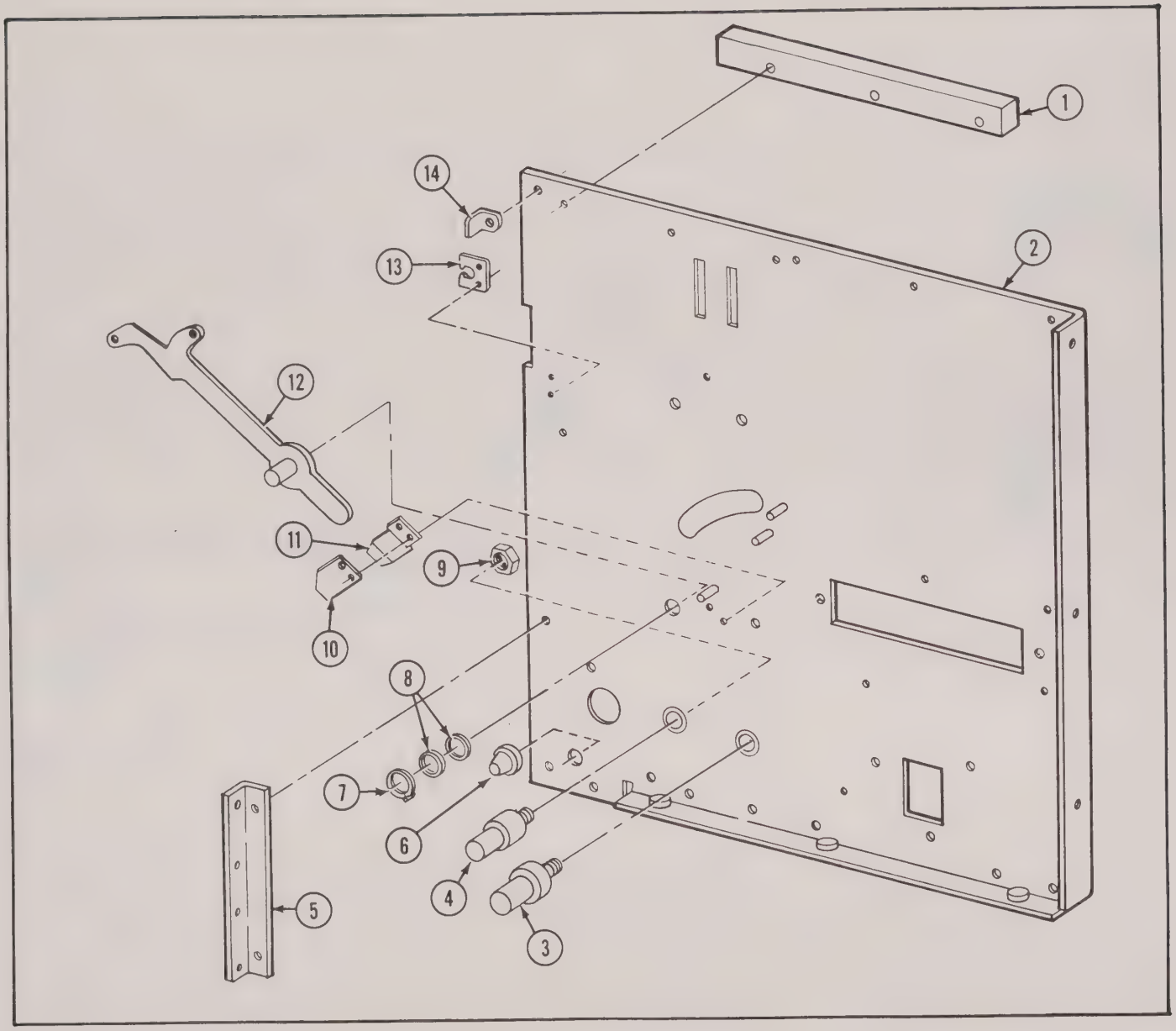


FIGURE 8-14 R.H. PLATE ASSEMBLY

EXPLODED VIEW PARTS LIST
BRAKE ASSEMBLY 683485
FIGURE 8-15

ITEM NO	PART NUMBER	DESCRIPTION
1	685127	Disk Assy
2	269291	Spring
3	0-108400-15	Insulation, Flex Sleeve
4	743913-10	Arm Subassy
5	0-240731-2	Ring, Retaining

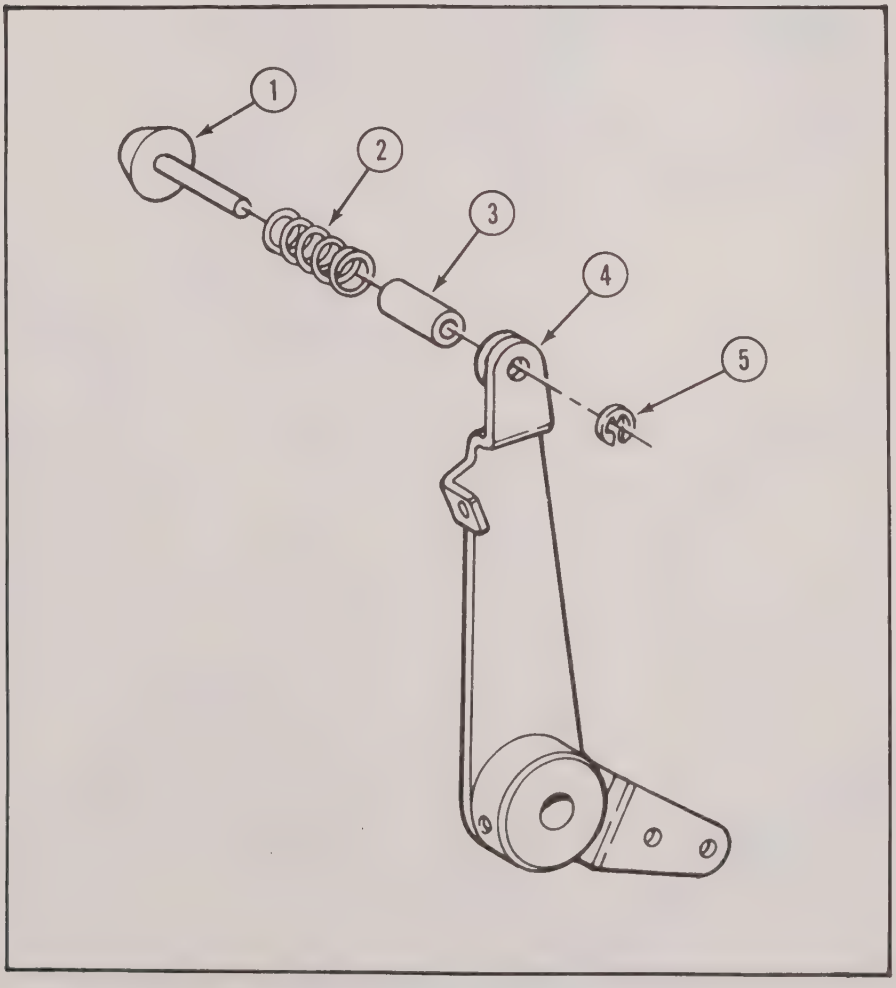


FIGURE 8-15 BRAKE ASSEMBLY

EXPLODED VIEW PARTS LIST
CHASSIS ASSEMBLY
FIGURE 8-16

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
1	785129-2	Drive Assy, 115V/60Hz (See Fig. 8-17)	
	786886-2	Drive Assy, 230V/50Hz (See Fig. 8-17)	
2	265814-4	Board, Terminal	TB-104
3	286484	Bracket	
4	486072	Chassis	
5	286026	Transformer, Power	T-101 and T-102
6	286024	Transformer, Control	T-109

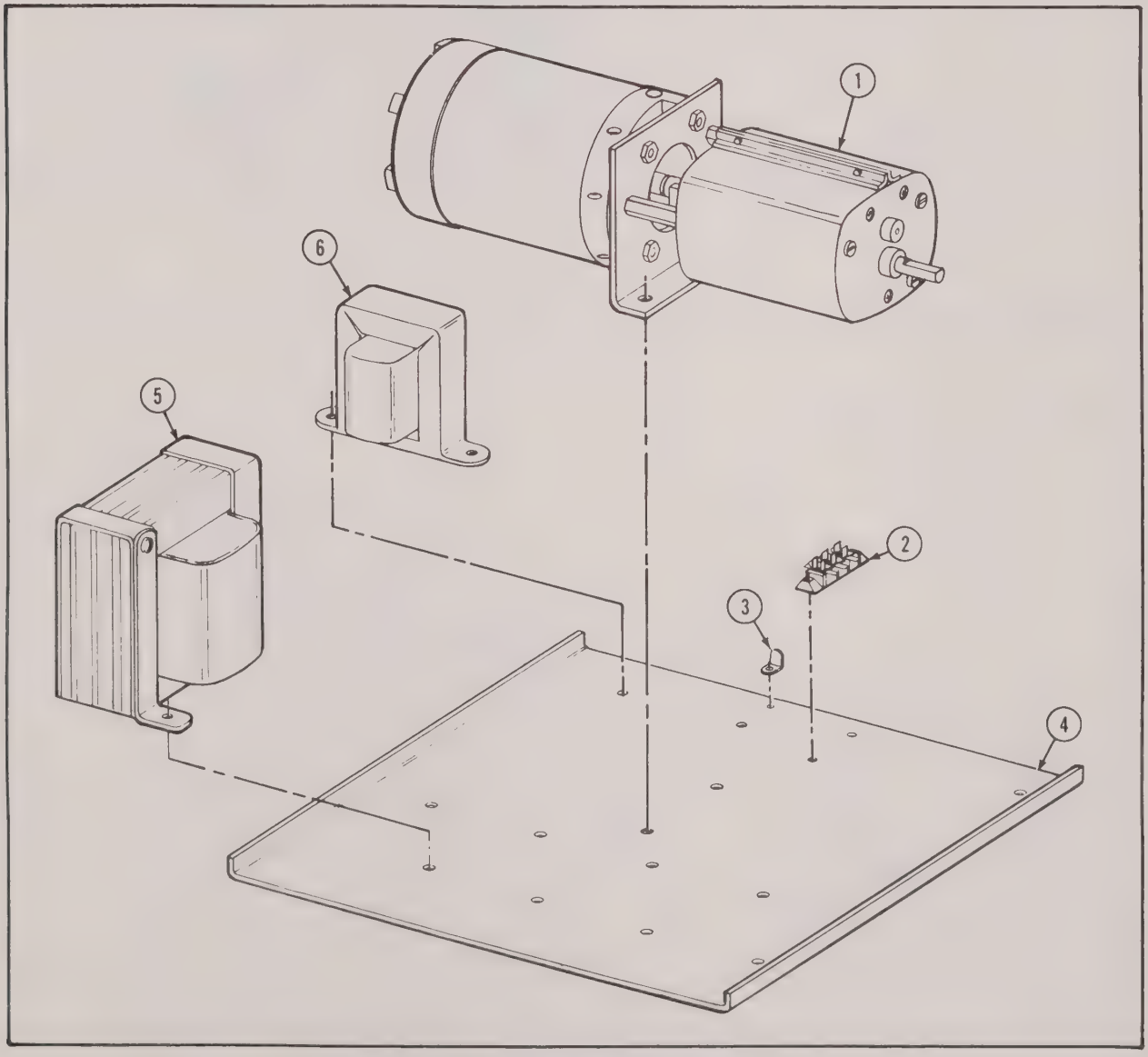


FIGURE 8-16 CHASSIS ASSEMBLY

EXPLODED VIEW PARTS LIST
DRIVE ASSEMBLY
FIGURE 8-17

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	785129-2	Drive Assembly (115V, 60Hz)	
	786886-2	Drive Assembly (230V, 50Hz)	
1	12-2155-08	Transmission Assy 115V/60Hz	A-111
	12-2157-08	Transmission Assy 230V/50Hz	A-111
2	127913	Coupling, Universal	
3	127911	Post	
4	123695	Core, Coupling	
5	127912	Coupling, Universal	
6	385617	Bracket, Motor Mounting	
7	232997-23	Strap, Retaining	
8	265840-2	Terminal Lug	
9	317713-2	Motor, 115V/60Hz	B-101
	267590	Motor, 230V/50Hz	B-101

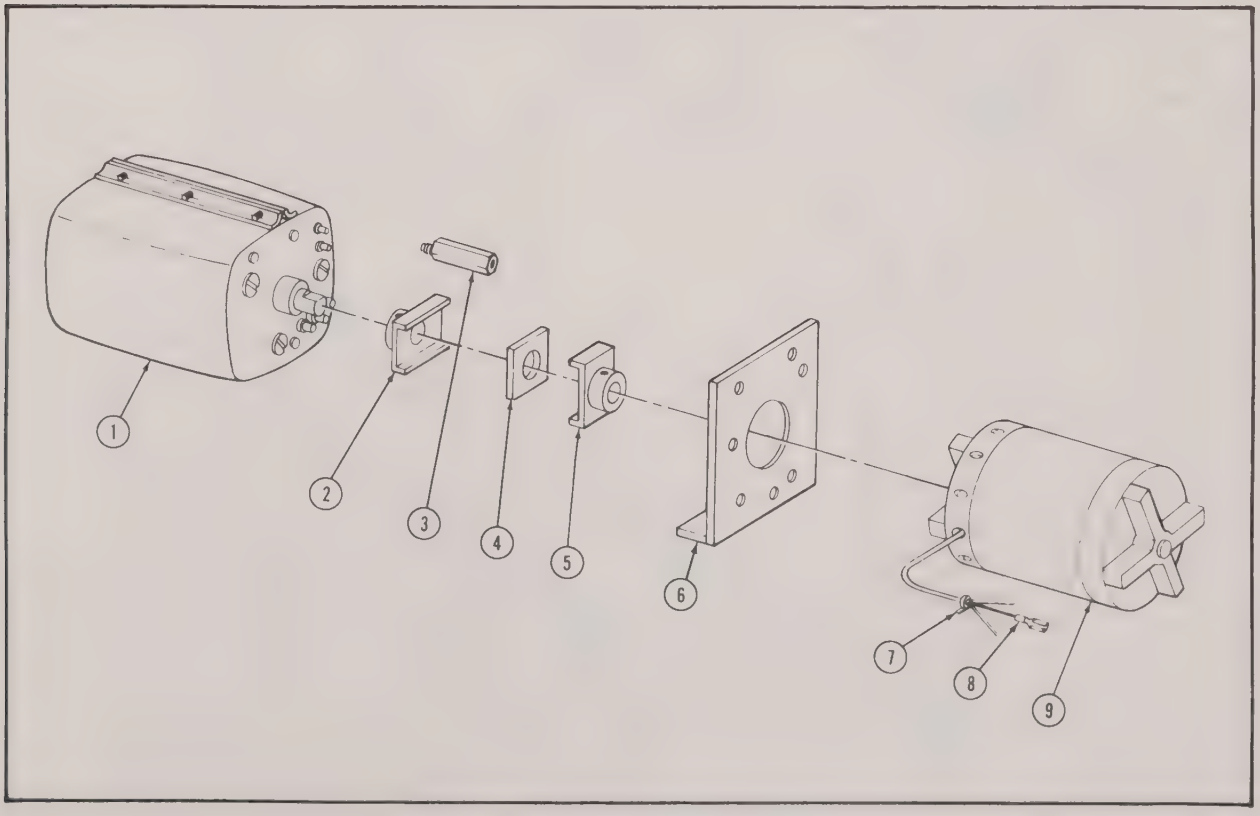


FIGURE 8-17 DRIVE ASSEMBLY

EXPLODED VIEW PARTS LIST
TABLE ASSEMBLY, WRITING
FIGURE 8-18

ITEM NO	PART NUMBER	DESCRIPTION
	888183	Table Assembly, Writing
1	785703	Bar Assy, Writing
2	785746	Paper Release Assy
3	343616-910	Support Assy, Right
4	4-112468-9	Roll Pin
5	1-210761-6	Bearing, Ball
6	285618	Roll, Pressure
7	688182	Bar Subassy, Pull
8	243867-1	Packing, Preformed
9	343617-910	Support Assy, Left

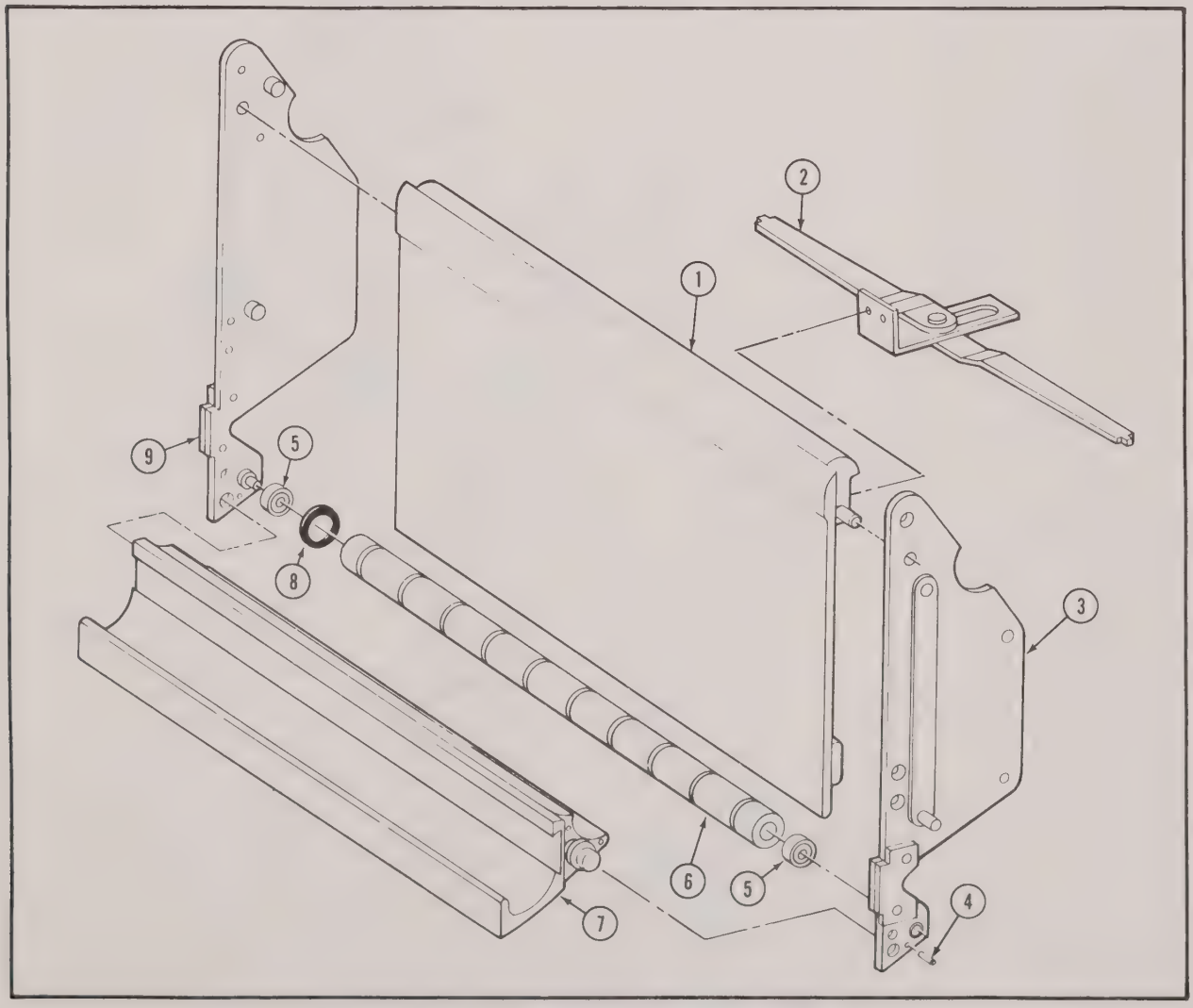


FIGURE 8-18 TABLE ASSEMBLY, WRITING

EXPLODED VIEW PARTS LIST
SENSOR ASSEMBLY
FIGURE 8-19

ITEM NO	PART NUMBER	DESCRIPTION	SYMBOL NO
	783590	Sensor Assembly	
1	286154	Switch, Sensitive	S-102
2	286386	Arm Switch	
3	743915	Arm Assy, Sensor	
4	286385	Spring, Torsion	
5	286384	Pin	

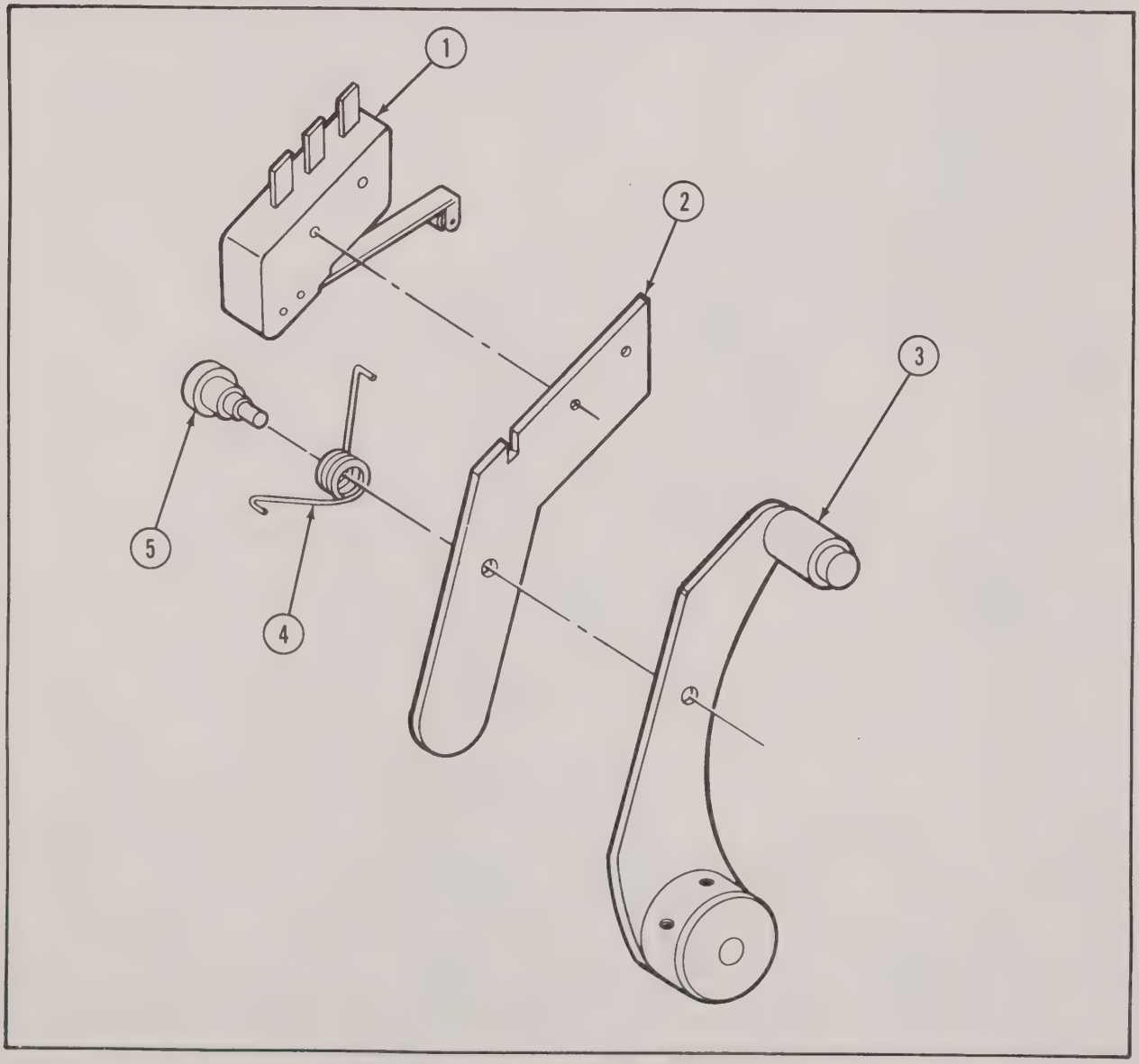
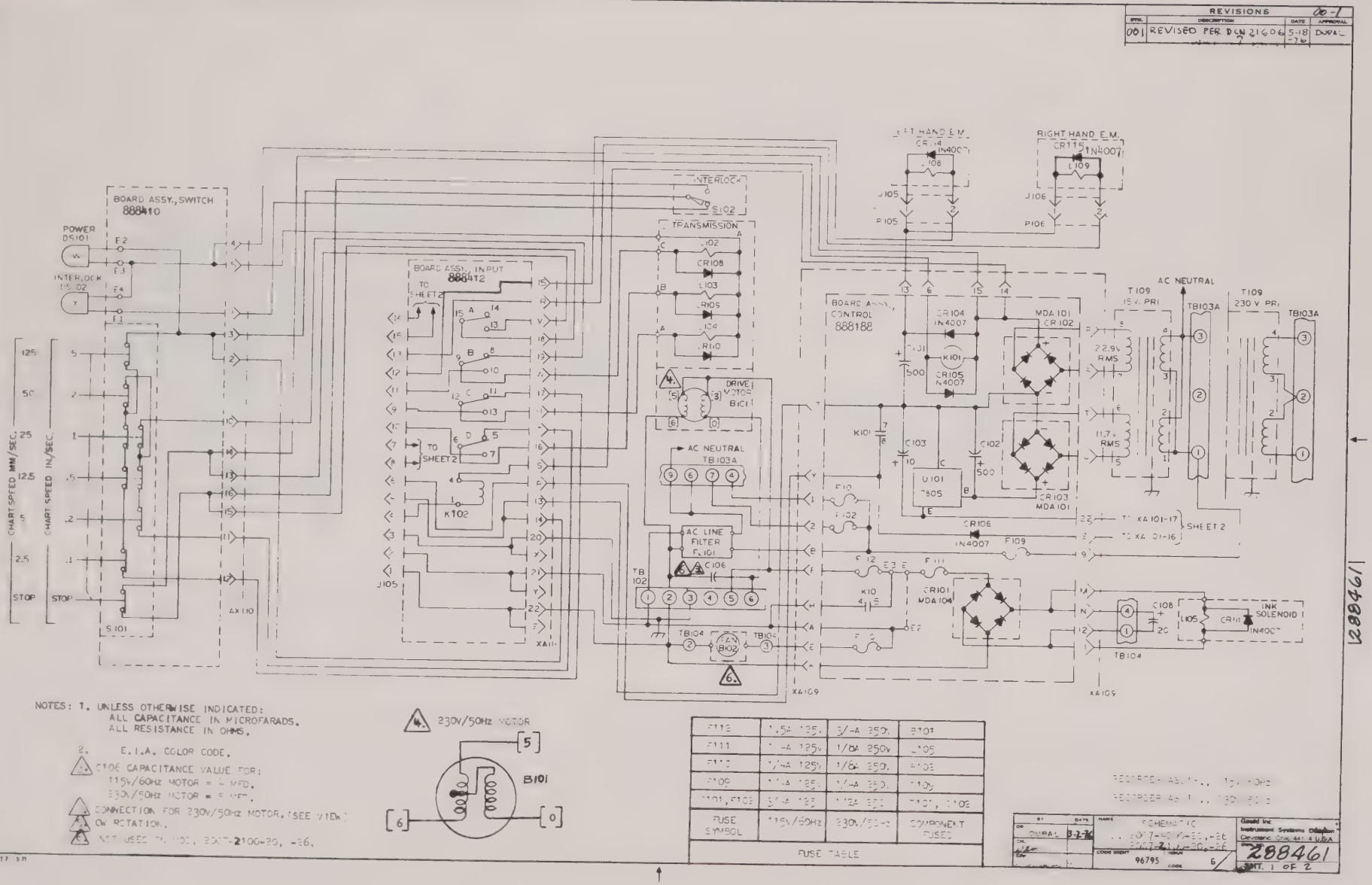


FIGURE 8-19 SENSOR ASSEMBLY



NOTES: 1. UNLESS OTHERWISE INDICATED:
ALL CAPACITANCE IN MICROFARADS.
ALL RESISTANCE IN OHMS.

2. E.I.A. COLOR CODE.

3. C106 CAPACITANCE VALUE FOR:
115V/60Hz MOTOR = 4 MFD.
230V/50Hz MOTOR = 2 MFD.

4. CONNECTION FOR 230V/50Hz MOTOR. (SEE VIEW)
CW ROTATION.

5. NOT USED ON 101, 230T-2100-30, -36.

4. 230V/50Hz MOTOR

FUSE SYMBOL	115V/60Hz	230V/50Hz	COMPONENT FUSED
F113	1.5A 125V	3/4A 250V	B101
F111	1 1/4A 125V	1/8A 250V	L105
F112	1/4A 125V	1/8A 250V	P105
F108	1/4A 125V	1/4A 250V	P106
F101, F102	3/4A 125V	1/2A 250V	F101, F102

FUSE TABLE

RECORDER ASSY., 115/60HZ
RECORDER ASSY., 230/50HZ

BY	DATE	NAME	SCHEMATIC
DRAWN	8-2-76	DUPAL	230T-2100-30, -36
CHK			230T-2101-30, -36
ENGR			
MFG			

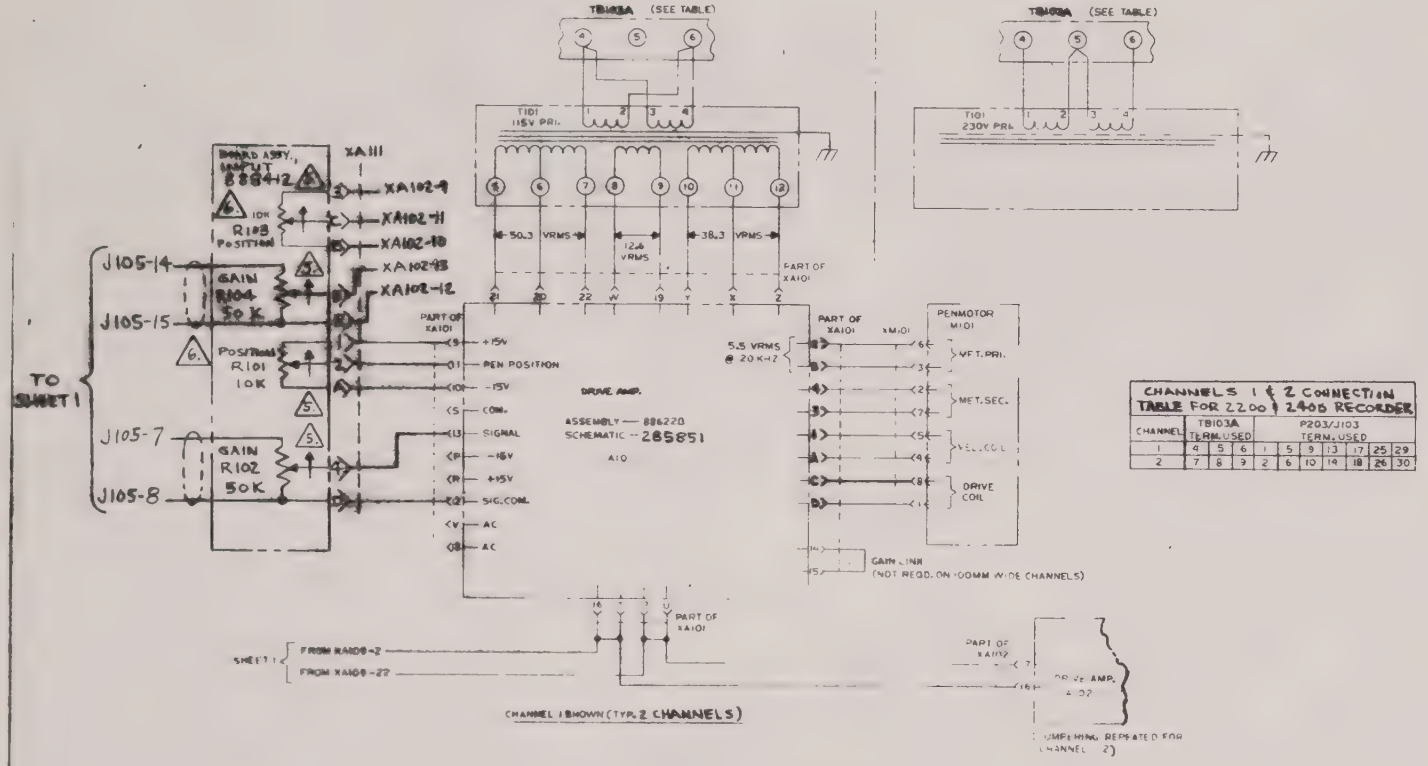
CODE IDENT 96795 SIZE D SHEET 1 OF 2

Gould Inc. Instrument Systems Division Cleveland Ohio 44114 U.S.A.

288461

288461/1

REVISIONS			00-1
	DESCRIPTION	DATE	APPROVAL
		MAY 27 1976	

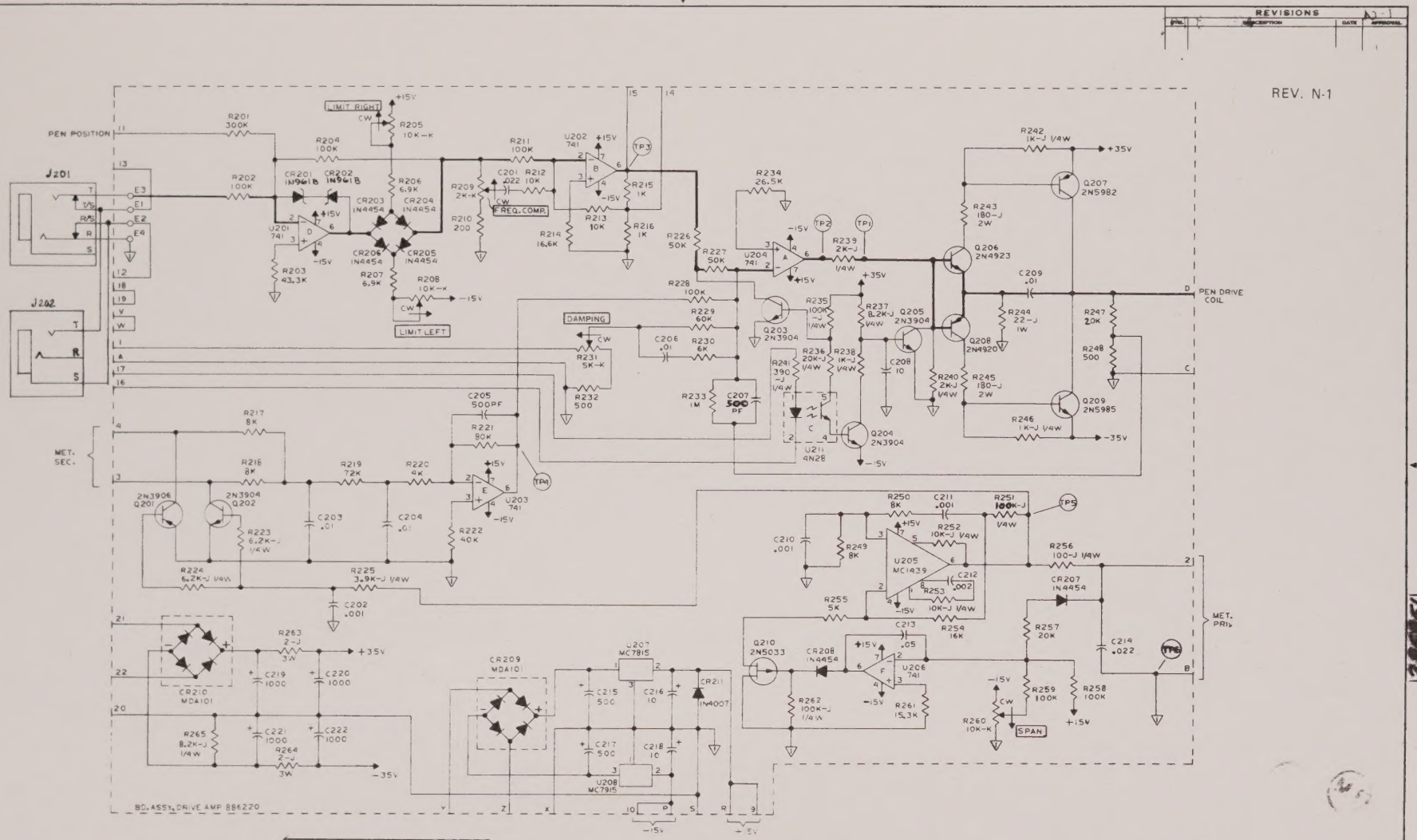


CHANNELS 1 & 2 CONNECTION TABLE FOR 2200 & 2400 RECORDER										
CHANNEL	TB103A TERM. USED			P203/J103 TERM. USED						
1	4	5	6	1	5	9	13	17	25	29
2	7	8	9	2	6	10	14	18	26	30

RECORDER ASS'Y., 115 V/60 Hz
[illegible]., 230 V/50 Hz

DRAWN BUPAL 7-7-76	NAME	MOD. 2400-00-00, -26	Gould Inc. Instrument Systems Division Cleveland, Ohio 44114, U.S.A.
CHECKED	ORDER NUMBER	96795	SIZE 288461 SHT. 2 OF 2

288461/1


REVISIONS
REV. N-1
PEN POSITION
J201
J202
LIMIT RIGHT
LIMIT LEFT
FREQ. COMP.
DAMPING
SPAN
PEN DRIVE COIL
MET. SEC.
MET. PRI.
BD. ASSY, DRIVE AMP 886220
THIS DRAWING IS USED BY OTHER GOULD DIVISIONS AND/OR LOCATIONS A F
RECORDER ASS'Y.
SCHEMATIC
2000 SERIES
Gould Inc
Instrument Systems Division
Cleveland, Ohio 44114 U.S.A.
285851
96795

MP MASTER
MA34578

Gould Inc., Instrument Systems Division
3631 Perkins Avenue, Cleveland, Ohio 44114
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